# ANNALS OF SURGERY

VOL. XLII AUGUST, 1905 No. 2

## ORIGINAL MEMOIRS.

### FINAL RESULTS IN THE X-RAY TREATMENT OF CANCER, INCLUDING SARCOMA.[1]

BY WILLIAM B. COLEY, M.D.,

OF NEW YORK,

Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital for Ruptured and Crippled.

SINCE February, 1902, or a period of over three years, I have made an earnest endeavor to determine the value of the X-ray in the treatment of malignant tumors.

At the beginning of this period there had been published a few reports of remarkable cases of cancer that had disappeared after a few weeks' or months' treatment with the X-ray. While most of these cases were of the cutaneous variety, or superficial epitheliomas, there were, in addition, a number of cases of recurrent cancer of the breast and two cases of inoperable sarcoma of the neck.

These reports gave rise to the hope that in the X-ray we had at least found something that offered relief, and perhaps cure, to that large class of patients afflicted with recurrent inoperable cancer, and possibly offered to patients suffering with primary cancer in the earlier stages, a larger prospect of cure than surgical operation.

Until it had been demonstrated that these apparently successful cases had remained free from recurrence sufficiently

[1] Read before the New York Surgical Society, May 10, 1905.

long to entitle them to be called cures, I then believed, and have since maintained, that the treatment should be strictly limited to inoperable and recurrent cancer, or applied as a postoperative measure that might possibly render recurrence less likely to take place.

The after-histories of these cases apparently successfully treated by the X-rays has proven the wisdom of such a course.

At the General Memorial Hospital, in February, 1902, through the liberality of Mrs. Collis P. Huntington and Mr. Archer M. Huntington, two X-ray machines were installed, and the work has been maintained up to the present time under the charge of Mr. W. P. Agnew and Dr. James Ogilvie, who have treated the cases under my direction during this period.

During this time there have been treated, including a few cases treated by myself personally outside of the hospital, 176 patients, as follows: 68 cases of sarcoma; 36 of carcinoma of the breast; 44 of epithelioma of the head, face, and neck, including tongue; 14 of deep-seated abdominal growths, probably carcinoma; 5 not classified; 3 of tubercular glands of the neck; 3 of Hodgkin's disease; 3 of lupus.

This gives us 167 cases of malignant tumors, sarcoma or carcinoma, in a total of 176 cases.

In five of the sixty-eight cases of sarcoma complete disappearance was observed, but in every one of these cases there was a recurrence a few months later. In two of these cases the recurrent growths disappeared again under the combined X-ray and toxin treatment. These two cases are still well at present. Of the other cases one died of internal metastases, one a sarcoma of the pectoral region and axilla was a local recurrence; the fifth case, a sarcoma of the chest-wall, involving the ribs and pleura, disappeared under the combined treatment with the X-rays and toxins, the X-rays having never been used alone. In this case there has recently been a recurrence which thus far has not yielded to further treatment with the X-rays or toxins.

In one case, a very rapidly growing sarcoma of the orbit with extensive involvement of the lymphatic glands of the

neck, very marked improvement followed the use of the X-rays, the glands of the neck nearly disappearing under a few weeks' treatment, and the tumor of the orbit also diminishing in size. The improvement, however, was of very brief duration; the tumor soon began to increase again rapidly and caused death in a few months.

The X-rays were used in three cases of melanotic sarcoma, starting in the skin of the ankle in two cases, and involving the femoral and iliac glands. In one case the X-rays were used for nearly two years, and seemed to have a decided influence in retarding the progress of the disease; in the other two, which were of much more rapid growth, the effect was apparently *nil*.

After having given the X-ray a very careful trial in sixty-eight cases of sarcoma in almost every locality, I am forced to the conclusion that, while in certain rare cases, especially of sarcoma originating in the lymphatic glands, improvement may be very striking, going so far, in some cases, as to cause entire disappearance, there is almost always a speedy recurrence, either local or metastatic, and that the influence of the X-rays upon sarcoma is rarely, if ever, curative. The case of Skinner may prove the single exception to this rule, although sufficient time has not yet elapsed to justify us in considering it a cure. (See elsewhere.)

The following is a brief history of the cases of sarcoma that disappeared under the influence of the X-ray or the X-ray and toxins combined, traced to final results:

CASE I.—*Extensive Recurrent Round-celled Sarcoma of the Neck, Both Sides, Superior and Infraclavicular, Pectoral and Axillary Regions on One Side, and Mediastinal Glands.*—The early history of this case is given in full in the *Transactions of the American Surgical Association*, 1902. The patient, M. A., aged forty-five years, was confined to bed and in such a hopeless condition that she was not expected to live more than two months. The toxins had been used with improvement at first, and finally abandoned. On February 10, 1902, at the General Memorial Hospital, I began the X-ray treatment purely as an experiment. The

improvement was more striking and rapid than in any other case that I have observed. The tumors steadily disappeared, and by July 1 there remained only a small nodule, the size of an almond, anterior to the sternomastoid muscle. This I removed under ether purely for pathological study, and the examination by Dr. George P. Biggs, of the New York Hospital, confirms the original diagnosis, and is of great interest. The patient regained her normal strength, and spent the summer in the country. She returned on September 24 with a local recurrence, the size of an English walnut, in front of the ear in the lower portion of the parotid. Both groins were filled with multiple tumors, varying in size from a hen's egg to that of a pigeon's egg. In addition, there was an intra-abdominal tumor, the size of two fists, smooth, globular, fairly movable, apparently originating in the ascending colon or its mesentery. There was undoubted constriction of the bowel at this point. Her condition again seemed hopeless. I resumed the X-ray treatment, and in three weeks the nodule in the parotid region had entirely disappeared, and the groin tumors disappeared within six weeks, and the growth in the abdomen decreased to about one-half its former size.

The treatment was kept up during the entire winter with steady decrease in the size of the abdominal tumor, and, continued in the summer of 1903, at Dartmouth, New Hampshire, under the general supervision of Dr. C. B. Nancrede. When the patient returned to me again in the fall, another nodule had appeared in the cervical region, the tumor in the abdomen seemed to be somewhat larger, and a few nodules were beginning to appear subcutaneously in the region of the thighs and abdomen. Her general health, too, had deteriorated. The X-ray treatment was again applied for a few weeks, but she grew worse very rapidly, new tumors appearing almost every day. Towards the end she suffered a great deal of pain in the sciatic and crural nerves. She died in June, 1904. At the time of her death, in addition to a large tumor in the abdomen, there were hundreds of nodules varying in size from a pea to a small egg, situated in the subcutaneous tissue and scattered over the entire body. One of these nodules was removed and examined at the Loomis Laboratory by Dr. B. H. Buxton. Examination showed it to be the same type of growth as all of the other specimens, namely, small round-celled sarcoma, apparently very little changed by the treatment.

CASE II.—*Small Round-celled Sarcoma of the Pectoral Region.*—E. M., aged thirty-five years. Family history good. Had been twice operated upon for round-celled sarcoma of the right pectoral region by Dr. Maurice H. Richardson, of Boston, and a microscopic examination made by Dr. W. F. Whitney at the Massachusetts General Hospital proved the growth to be round-celled sarcoma. The last operation was performed in October, 1901. The disease then involved the pectoral and axillary regions so widely that it was impossible to make a complete removal. Amputation of the upper extremity was considered, but not thought advisable. The patient was referred to me by Dr. Richardson in October, 1901. The mixed toxins were administered five to six times a week for three months in doses sufficient to produce a marked reaction. The tumor softened, and in January, 1902, a spontaneous opening occurred, with evacuation of about a pint of necrosed tumor tissue, as a result of which the growth was reduced about two-thirds. In February, 1902, the X-rays, plus toxins, were administered, causing continued decrease in the size of the tumor. In June, 1902, the growth had entirely disappeared, and the patient returned to Rhode Island in good condition. He worked hard every day and gained twenty pounds in weight. An examination, January 5, 1903, showed the patient's general condition still perfect, but about two inches below the clavicle, in the pectoral region, there was a small movable nodule the size of a hickory-nut. He returned to the General Memorial Hospital on February 3, 1903, for the combined toxin and X-ray treatment, with the result that in six weeks the recurrent tumor had again disappeared, his general health remaining perfect.

This case was shown before the meeting of the American Surgical Association in June, 1903. In December, 1903, the patient had a slight local recurrence, which disappeared under renewed X-ray and toxin treatment. He remained well until the early part of 1904, when he had a local return, which has never entirely disappeared. The patient has been able to attend to his regular duties up to the present time. In a letter of May 31, 1905, he stated that he was working every day, and that his condition had remained about the same since I saw him a year ago, since which time he had gone entirely without treatment. On July 5, 1905, I examined him, and found him with extensive local

recurrences and evidences of extension into the lung and pleura. He was much emaciated, and his condition hopeless.

CASE III.—*Small Round-celled Sarcoma of the Back.*—W. J., aged eleven years. Family history good. In the latter part of August, 1901, the patient fell from a stoop, striking on his back. Two or three weeks later the mother noticed a swelling in the midscapular region, a little to the left of the median line. This swelling increased very rapidly. It was soft and fluctuating from its beginning. The patient was referred to me in December, 1901, by Dr. Polhemus, of Nyack, New York. Physical examination at that time showed a cystic swelling the size of an orange in the left scapular region. The skin was normal, the tumor fluctuating, situated apparently just beneath the skin and superficial fascia. On January 12, 1902, an incision was made under ether and several ounces of dark blood were evacuated. There was no evidence of any solid tumor at this time. The wound closed without drainage and healed by primary union. About three weeks later a tumor began to develop at the original site; this was also cystic in character, increased rapidly in size until May, when it had become one-third larger than at the first operation. I then operated again under ether anæsthesia, finding at this time, in addition to fluid blood and clots, such a thickening of the walls of the cyst as to make me suspicious of sarcoma. A portion of this thickened tissue was removed and examined by Dr. H. T. Brooks, Professor of Pathology at the Post-Graduate Hospital, who pronounced it small round-celled sarcoma of high vascularity. Two weeks after the operation and before the wound had entirely healed, the X-ray treatment was begun and continued three times a week. The treatment was kept up the entire summer and fall of 1902. In December, 1902, there was well-marked evidence of local recurrence in and about the cicatrix. The tumor continued to increase in size in spite of X-ray treatment. On January 26, 1903, I operated a third time under ether anæsthesia and removed the recurrent tumor together with the old cicatrix. The wound healed by primary union. Shortly after he left the hospital, the X-ray treatments were resumed, and continued once or twice a week during all of 1903 and the first half of 1904. In June, 1904, there began to appear signs of another recurrence in the old cicatrix, and this time, in addition to the X-ray, I began the local injections of the mixed toxins of erysipelas and Bacillus pro-

digiosus. The injections have been continued from July 1 up to the present time, June 19, 1905, two or three times a week, with two X-ray treatments a week, with the result that the recurrence slowly disappeared, the ulcerated area healed over, and at the present moment there is no trace of a growth anywhere visible. The boy's general health has remained perfect up to the present time.

CASE IV.—*Round-celled Sarcoma of Femur involving the Lower Two-thirds of Shaft.*—A. G., aged nineteen years. A swelling was first noticed in the lower portion of the femur in November, 1901. This gradually increased in size, being accompanied by loss of weight and deterioration of general health. Physical examination on February 5, 1902, showed a large tumor extending from the condyles of the left femur to the junction of the middle and upper third. There was a fusiform enlargement of the entire lower two-thirds of the femur. On the outer aspect of the thigh, about one and one-half inches above the joint, there was a soft, fluctuating area just covered by thin and reddened skin. There was slight impairment of the functions of the joint itself. An incision was made under ether into the fluctuating area, and two to three ounces of clear serum, similar to that which is found in cystic degeneration of sarcomatous tissue, were evacuated. A curette was passed into the cavity of the bone and typically sarcomatous tissue removed. Microscopic examination by Dr. E. K. Dunham showed it to be a round-celled sarcoma. The patient absolutely refused amputation at the hip, which I strongly advised.

The X-ray treatment was tried entirely as an experiment, four exposures a week being given for a month, at the end of which time the circumference of the tumor had decreased one inch. The treatment was discontinued for two weeks, during which interval the tumor had again increased nearly an inch. The treatment was resumed, and at the end of another month the circumference of the thigh over the centre of the tumor was one inch less than the original measurement. The treatment was continued the entire summer to December, 1902. At this time the measurement of the left leg was the same as that of the right. There was still some thickening in the lower part of the femur. The old sinus, which had never healed after the exploratory incision, was enlarged under ether and carefully curetted. Examination of the

tissues failed to show any trace of sarcoma. The patient had gained twenty pounds in weight, but towards the end of December, 1902, began to show signs of a metastatic tumor developed in the left pectoral region; this grew rapidly until it became about the size of a hand, when it was partially removed under ether anæsthesia; it was found to be very soft and highly vascular. Shortly after this, a large tumor, the size of a child's head, developed in the right iliac fossa, extending from the costal cartilages down to the pelvis; it could be easily felt in the lumbar region. The local treatments with the X-ray in the femur and pectoral regions were continued, and in addition the mixed toxins of erysipelas and Bacillus prodigiosus were begun. After a few weeks the large tumor in the iliolumbar region began to soften and break down, and on becoming completely fluctuating was opened posteriorly. A very large amount of necrotic tumor tissue was evacuated and the sinus was drained for about a year. While the tumor in the leg had apparently disappeared, there remained a marked thickening of the bone, and the sinus leading to the broken-down area persisted. Examination of several curettings failed to show any longer evidence of sarcoma. At the present time, three and one-quarter years after beginning of treatment, aside from the sinus in the leg, the boy appears to be in perfect health. There is at present no evidence of sarcoma to be found.

Case V.—*Inoperable Round-celled Sarcoma of the Chest-wall, Involving Ribs, treated by the X-rays combined with the Toxins of Erysipelas and Bacillus Prodigiosus.*—G. C., sixteen years of age, enjoyed good health up to 1903, when he had an attack of what was considered to be pleurisy with effusion. He was aspirated, but the dulness over the chest persisted, and he rapidly lost flesh and strength. He was sent south, without improvement, and in October, 1903, entered the Johns Hopkins Hospital, where he was operated upon for a supposed empyema. A large incision was made, revealing a necrosis of the eighth and ninth ribs, and behind these some gelatinous masses were found. These were partially removed and examined by Dr. Welch who pronounced them round-celled sarcoma. The patient was referred to me, and on May 26, 1904, was admitted to the General Memorial Hospital, where for two months the toxins were regularly administered; in addition, he received X-ray treatment

three times a week. At that time the patient was so weak that he could hardly walk. There was a mass about the size of a man's hand over the ribs, with an extensive, sarcoma-like sloughing area in the centre. The improvement was very rapid, and when he left the hospital in the fall of 1904 there was no trace of the tumor left; the patient had gained twenty-five pounds in weight and seemed in perfect health. He returned to his home in Canada, where his family physician had been instructed to continue the toxin treatment in smaller doses two to three times a week.

By the end of January, 1905, the patient returned to New York for examination, and there was evidence of a local recurrence, which at first again showed some improvement; after a few weeks, however, the tumor began to slowly increase in size in spite of large doses of the toxins and regular and prolonged X-ray treatment. The growth was thoroughly curretted in March and again on June 8. At the last operation a mass of soft, vascular sarcomatous tissue, about the size of a small orange, was scooped out with a large spoon from within the chest-wall. Hæmorrhage was very profuse, but was finally stopped by tight packing. After an infusion the patient rallied well from the operation. At present there remains an area of tumor tissue on all sides of the cavity, involving the bony structures as well as the soft parts and extending deeply into the lung. The prognosis seems hopeless.

Case VI.—*Inoperable Intra-abdominal Sarcoma involving Mesentery, Mesenteric Glands, and a Portion of the Small Intestine, which disappeared entirely under Four Months' Treatment with the X-rays and Toxins combined.*—Mrs. W. was operated upon in November, 1903, by Dr. William M. Conant, of Boston, for abdominal tumor. It was thought to be connected with the uterus or ovary, but an infiltration into the small intestine was found. There was also in the posterior peritoneal part of the mesentery a growth fully as large as the closed fist. The growth was so extensive and suspicious that no attempt was made to remove it. Pathological examinations made by Drs. W. F. Whitney and A. C. Potter proved the disease to be round-celled sarcoma. The patient was then referred to me by Dr. Conant, and I began the combined X-ray and toxin treatment, with the result that the tumor entirely disappeared in four

months' time. After this the patient developed high temperature with acute abdominal symptoms, pointing to local peritonitis. She was desperately ill and all hope of life was abandoned for more than a week. A fæcal fistula finally developed, and she slowly recovered her health. She is alive at present, one and a half years afterwards. In January, 1905, a small mass could be felt in the lower portion of the abdomen, at the site of the original tumor, and, as it increased slowly in size, the treatment was resumed by her former physician, Dr. W. E. Wilson, of Pawtucket. The growth has not again disappeared, though there has been improvement.

## CARCINOMA OF THE BREAST.

The thirty-six cases of cancer of the breast treated by the X-ray furnish almost every variety of the disease, from the cancer "en cuirasse," with extensive lymphatic involvement and œdema of the arm, to the small, superficial, recurrent cancerous nodules along the site of the old cicatrices. In addition, the X-ray was used in four cases as a prophylactic immediately after operation for the primary growth. I regret to say that these cases furnish little encouragement for the use of the method as a prophylactic measure, since in every instance a recurrence took place within a few months, while the patient was still undergoing the treatment. While in one case there was no definitely recognized recurrence in the pectoral or axillary regions, the patient died of general metastases within a year's time. In two other cases, very small recurrent nodules, just beneath the skin in the neighborhood of the old cicatrix, disappeared after a few weeks' treatment, but in both cases there was a speedy return, and the treatment seemed to have little effect in checking the steady progress of the disease towards a fatal issue.

In one instance the X-ray was used in a primary operable tumor, presenting all the clinical appearances of carcinoma, although no microscopical examination was made. Every effort was made to induce the patient to submit to an operation, but she absolutely refused. She was told that the X-ray treat-

ment was purely experimental and probably would do no permanent good.

The patient, aged forty-five years, married, with negative family history, had a tumor in the right breast of about eight years' growth. No history of trauma. Examination made in April, 1902, showed a tumor of about the size of a large English walnut in the upper portion of the right breast. The tumor was very hard, the skin was adherent; axillary glands were not involved. The patient was given the X-ray treatment three times a week during the spring and summer of 1902, with the result that there was some decrease in the size of the tumor and increase in mobility. On discontinuing the treatment for a few months, the tumor again began to increase in size. She received intermittent treatment up to two months ago, and sometimes would go several months without any exposures. At present the tumor is about the same as it was three years ago. There is still no involvement of the axillary or mediastinal glands.

I do not feel absolutely sure that the case is carcinoma, although from the clinical appearances I have little doubt. If so, the disease has certainly been held in check for three years, although of late her general health is not so good, and she has had a severe bronchitis, which may be evidence of internal metastases.

In my entire experience with the X-ray, I have seen but one case of deep-seated carcinoma in which the tumor disappeared.

The patient, Mrs. M. D., forty years of age, married, no children, was suffering from a very extensive ulcerative carcinoma of the right breast which had destroyed the entire breast, involving periosteum of the ribs and sternum. The X-ray treatment was begun in December, 1902, and continued until May, 1903, during which time the disease apparently completely disappeared. The patient's general health remained good. About a year ago she had a severe attack of pleuritis, which was supposed to be an extension of the disease into the pleura and lung, and for a number of weeks she was not expected to live. She

gradually recovered her health, however, and for nearly a year has been able to be up and about. During this time there has been gradual extension of the disease into the other breast, which is now completely involved, and physical examination shows undoubtedly the presence of large deposits in the right lung, which cause her a good deal of dyspnœa on exertion. She has marked dilatation of the right pupil, and, after gradual diminution of vision, she is now totally blind on the right side. The X-ray treatment has been continued almost the entire time during the last year. At present she is up and about and goes out every day, although her general condition is gradually failing. She has recently developed slight facial paralysis.

In this case the X-ray has undoubtedly prolonged her life for a considerable period, although the tumor originally was of comparatively slow growth, having existed nearly three years prior to the beginning of the X-ray treatment.

## EPITHELIOMA.

We have treated forty-four cases of epithelioma of the head, face, and neck. In this number are included cases of epithelioma originating in the lip or tongue, later involving the glands of the neck. Ten cases were epithelioma of the nose; ten superficial epithelioma of the face. In only four cases did the disease disappear entirely. In every case in which there was involvement of the glands of the neck, no improvement whatever was noticed, and the rays had little, if any, effect in retarding the disease. This was especially noted in tumors originating in the tongue or lip, showing that some of the very small epitheliomas of the face often fail to yield to X-ray treatment. I will cite one case of epithelioma involving a small area of the lower eyelid and the skin in the region of the inner canthus, which was treated for a period of seven months without disappearance. Another case, an epithelioma of the face, but little larger than a pea, but involving the deeper layers of the skin, showed no improvement after two months' treatment with the X-rays. The patient submitted to excision, which had been strongly advised at first.

The X-ray was used in four cases of carcinoma of the abdomen probably originating in the sigmoid or cæcum, and in one case of high rectal cancer with extensive involvement of the sigmoid. In the latter the growth decreased slightly in size and the pain was somewhat controlled by the X-ray treatment. His condition then grew worse and he died suddenly a short time later. It is very doubtful if his life was much prolonged by the treatment. In the other cases there has been no effect whatever upon the intra-abdominal growths.

Four cases of malignant disease of the larynx and one of the œsophagus showed absolutely no improvement under the treatment.

In one of the three cases of Hodgkin's disease treated with the X-ray, there was very remarkable improvement at first. The glands of the neck, axilla, and groin disappeared entirely, and the spleen, which was of enormous size, decreased to one-third of its original dimensions. However, after about six months the patient had a sudden attack of pain in the epigastrium, with vomiting and jaundice and moderate rise of temperature. The symptoms increased in severity and he died in two weeks. No autopsy. The second case of Hodgkin's disease was not traced, and a third is at present under treatment.

Of the three cases of lupus, the disease disappeared entirely in two and there was marked improvement in the third. In one of the cases of tubercular glands of the neck, the glands markedly decreased in size; in one they disappeared, and in the third case there was slight involvement.

## CASES OF EPITHELIOMA OR CARCINOMA THAT DISAPPEARED UNDER X-RAY TREATMENT.

Case I.—F. S., male, fifty-five years old. Superficial epithelioma of the forehead, about the size of a silver half-dollar, of thirty years' duration. Treatment was begun in March, 1902, and continued until April 6, 1903, when it was discontinued on account of a burn. At this time the growth itself had almost entirely disappeared. The patient was examined on May 1,

1905, three years after the beginning of the treatment, and was found perfectly well.

CASE II.—Mrs. S., sixty-three years of age. Small epithelioma of the forehead of seven months' duration. The treatment was begun in June, 1903, and kept up with intervals of rest until March 30, 1905. May 1, 1905, examination showed no return of the growth.

CASE III.—Mrs. A., aged thirty-four years. Small ulcer, one-half inch in diameter, situated upon the end of the nose, about one year's duration. In this case the clinical diagnosis was not positive, and it was believed that the ulcer was probably of syphilitic origin. It disappeared after one month's treatment, and examination nearly three years later, on May 1, 1905, shows no return of the trouble.

CASE IV.—Mrs. F., forty-nine years of age. Recurrent inoperable carcinoma of the cervix. First operation was done on September 22, 1901, by Dr. C. H. Fredericks, of the Woman's Hospital, at Buffalo. Reappearance of bloody discharge in April, 1902, at which time the case was considered inoperable by Dr. Jarman of the General Memorial Hospital. X-ray treatment begun May 5, 1902, and continued for about four months, at the end of which time the growth had entirely disappeared. The patient is well at the present time. In this case, unfortunately, no microscopical examination was made to confirm the clinical diagnosis. In view of the fact that the trouble disappeared after such a short period of treatment, the diagnosis of carcinoma cannot be regarded as positive. In fact, Dr. Fredericks writes me that he is inclined to think there was an error in diagnosis.

The only other case that remains well at the present time is the case of sarcoma of the femur already described, in which, six months after the X-ray treatment was begun, extensive metastases occurred in the pectoral region and iliac fossa. At this time he was placed upon the mixed toxins of erysipelas and Bacillus prodigiosus. The large tumor in the iliac fossa broke down and was evacuated. After long-continued treatment, the patient is at present well, without visible evidence of a return. This case can by no means as yet be regarded as a

cure, although, in view of the fact that so very few cases of periosteal sarcoma of the femur are cured even by hip-joint amputation, or life prolonged beyond two years, the case is of great interest.

I have made an effort to trace to final results certain reported successful cases of deep-seated malignant tumors treated by other men.

CASE I.—*Round-celled Sarcoma of the Neck*, treated by DR. C. E. SKINNER, of New Haven, and published by Dr. Frank A. Kirby (*Journal of Advanced Therapeutics*, February, 1902).

The patient, male, aged sixty-four years, three years ago received a blow upon the neck from a wagon-pole, leaving a contusion which lasted about a week. Two months later a swelling appeared at the site of the injury. This grew very slowly for about sixteen months, when the patient severely wrenched his neck. Almost immediately afterwards the tumor began to grow more rapidly, and became painful. By November, 1901, the tumor had become very large, and occupied the greater portion of the left mastoid and cervical region, measurements being seven inches laterally, ten inches vertically, with some ulceration and breaking down. Microscopic examination by Dr. Archibald McNeal, of the New Haven Board of Health, showed the tumor to be round-celled sarcoma. The X-ray treatment was begun November 20, 1901, by Dr. Skinner, a Van Houten and Tenbrook 32-inch twelve-plate static machine being used. Dr. Skinner states that in the incredibly short space of time of six weeks the patient was apparently cured, the tumor having disappeared, the surface healed, and the patient being free from pain, and able to resume his work.

On June 27, 1902, I made a personal examination of this case and found the following conditions:

In the left side of the neck and mastoid region is a very large, broad cicatrix, measuring two and one-half by three and one-half inches, but there is absolutely no trace of a recurrent growth. In the lower part of the cervical region there can be felt on deep pressure very slight enlargement of one or two of the deep cervical glands, apparently no longer than peas.

In a letter, received in the latter part of 1903, his physician states that the patient began to lose rapidly in general health, and died about five months later. No autopsy was made, but there is little doubt that his death was due to internal metastases.

CASE II.—Male, aged seventy years, with small round-celled sarcoma of the neck, six times recurrent, and apparently absolutely hopeless. The X-ray treatment was begun by Dr. E. R. Fiske, of Brooklyn, on December 22, 1901. A static machine was used daily, and exposures of ten minutes' duration were given the first few weeks; these were gradually lengthened to twenty minutes, and the treatment was continued, with occasional

intervals of rest, for a year. At the X-ray meeting of the Academy of Medicine, March 9, 1902, I showed the patient in perfect health, and there was not the slightest suspicion of tumor or induration in the neck. A communication from Dr. Fiske, dated January 23, 1903, states that the patient is free from recurrence, in fine health, and has gained in weight. In a later letter it is stated that he died on September 23, 1903, under symptoms of cerebral thrombosis. Here again there is strong probability that death was due to generalization of the disease.

The after-histories of two cases of malignant tumor that had been previously under my care and were later apparently successfully treated with the X-ray by Dr. William J. Morton, of New York, as reported in the *Medical Record* of March 8, 1902, are of interest:

One, a recurrent carcinoma of the breast, the size of a bean, disappeared under three weeks' treatment from January 30 to February 19, 1902, and is reported as cured except as to usual possibility of a recurrence. Two months later, however, this patient died of extension of the disease into the lung and pleura.

The other case was an extensive sarcoma of the mastoid region in which the mixed toxins had been tried and failed. At the time of the beginning of the treatment, January 25, 1902, there was a large bony tumor in front of the ear and a soft tumor, three by two inches in size, behind the ear. The patient suffered intense pain and was taking one-half grain of morphia every two to three hours. After a few treatments the pain ceased and both swellings decreased in size. At the time of the report, February 20, 1902, only a small lump of the soft tumor remained, and the pain had entirely ceased. Later, the X-ray lost its influence upon the disease, the patient's general health slowly deteriorated, and she died within three months after the case was reported.

In the *Johns Hopkins Bulletin*, June, 1904, p. 192, Professor E. Schiff, of Vienna, reports a case of cancer of the mamma cured by means of the Röntgen ray. The patient came to him on February 7, 1903, with an inoperable cancer of the left breast, extending from the edge of the sternum to the midaxillary region, 8 centimetres in width and 5 centimetres elevation, with an ulcerated surface and five small nodules in the back. The X-ray treatment was begun and marked improvement was noted

from the start. On June 5, or less than four months from the beginning of the treatment, the last record was made. At this time it is stated that "excepting some excoriated patches, a flat scar, crossed by some enlarged veins, had taken the place of the tumor; the cutaneous metastases had disappeared, the group of supra- and infraclavicular glands had decreased in size and become softened." This description of the condition makes it quite clear that the disease had not entirely disappeared. Inasmuch as there is no after-history of the case, there seems to be little warrant for reporting it cured.

In the *Beiträge zur klinischen Chirurgie*, vol. xxxvii, 1903, Mikulicz reports a case of deep-seated cancer of the male breast which apparently disappeared under the use of the X-rays. The case is briefly as follows:

The patient, a man fifty-two years of age, was admitted to the Breslau Clinic on July 23, 1902, suffering from an ulcerating tumor of the left breast, claimed to be due to an injury sustained two years previously. The diagnosis of carcinoma of the breast with metastases in the glands of both axillæ was made. It was decided to clean out the axillæ and treat the breast ulcer with the X-rays. The operation was performed on July 1, 1902. Microscopic examination of the piece of the breast tumor that had been excised for this purpose showed it to be a simple mammary carcinoma. The axillary glands, too, proved to be extensively infiltrated by the disease. The X-ray treatment was begun on the 2d of July. By the end of the month the ulcer had decreased from 7 by 3 centimetres to 5 by 1½ centimetres. A piece was then excised in the neighborhood of the former excision and examination showed no carcinomatous cell present. The patient was discharged on the 2d of August, and examination on October 22 showed a smooth scar, pink, soft, and movable. No indurated tissue below or around the scar nor in the axillary cavity.

In a later paper (*Beiträge zur klinischen Chirurgie*, Band xliii, p. 505), Mikulicz gives a complete *résumé* of his results obtained from the use of the X-ray in cancer. He reports thirty-seven cases: of these eighteen were carcinoma of the skin, two of the buccal cavity, one of the lymph-glands of the neck, five of the œsophagus, and eleven of the breast. In the latter series we also find the later history of the above cited case. It is there stated that two months later the scar had reopened, evidently as a result of maceration due to inefficient bandages; no local recurrence; but outside of the exposed area, near the axilla, a hard nodule, the size of a bean, was found. Extirpation and closure of scar. Three months later, local recurrence. Excision of recurrent nodules, including portions of scar. Re-examination eight months later. No recurrence.

Mikulicz's results also show the influence of the X-rays upon other than carcinoma of the skin to have been very slight. While in a few of his cases of carcinoma of the breast the disease apparently disappeared, recurrence, either local or metastatic, followed in every instance.

His conclusions are, that in carcinoma of the skin, especially ulcus rodens, so long as the lymphatic glands are not involved, complete cure may be effected by the use of the Röntgen rays, and that in this class of cases the X-ray treatment is of equal value to that of operation, and perhaps even superior, in view of the better scar resulting after the X-ray treatment. He would, however, exclude the treatment in the more deep-seated operable growths, while in the inoperable cases he thinks improvement with a chance of cure may result from the combined preliminary operative and subsequent X-ray treatment.

As regards operable cancer of the breast, he believes these cases should never, even under most favorable circumstances, be subjected to X-ray treatment, since here all depends upon attacking the entire lymphatic region; and while the knife may accomplish this, he knows of no case in which the X-rays have been successfully employed. The Röntgen-ray treatment should be strictly confined to inoperable cases, in which it may cause improvement, though hardly ever a cure.

There is a possibility that the case of large fibrosarcoma of the abdomen treated by Skinner, of New Haven, may prove the single exception to the rule of recurrence after X-ray treatment. The history of this case is so remarkable that it merits a brief *résumé:*

M. G. H., female, thirty-four years old, was referred to me by Dr. Maurice H. Richardson, of Boston, on April 19, 1901. She had been operated upon three years before for what was supposed to be a fibro-adenoma of the uterus; tubes and ovaries were removed. No microscopical examination was made. Two months prior to her coming to me, she had noticed a large tumor in the lower part of the abdomen in the region of the cicatrix. Physical examination at that time showed a tumor the size of a cocoanut in the lower part of the abdomen, filling up the entire iliac fossa extending nearly to the umbilicus, two inches beyond the median line to the left. The tumor was firmly fixed and seemed to involve the abdominal wall. An incision was made under cocaine, and a portion of the growth, which infil-

trated all the muscles of the abdominal wall, was removed, and on microscopical examination proved to be fibrosarcoma I used the erysipelas and Bacillus prodigiosus toxins more or less constantly until January, 1902, at first with marked diminution in the size of the tumor, but later with very little effect, and, finally, the tumor began to grow in size very rapidly. I regarded the case as entirely hopeless. The patient had lost much weight and had begun to be cachectic. The X-ray treatment was begun by Dr. Clarence E. Skinner, of New Haven, on January 28, 1902. Forty-six applications were given up to June 5, by which time the lateral circumference of the tumor had increased from thirteen and three-quarters to fifteen inches. She had had several attacks of fever lasting for a few days, with symptoms of toxæmia, probably from absorption. Her general health, however, improved considerably during this time. From June to September she received thirty-one treatments, and during this time there was so much local and general improvement that she decided to resume her work as a school-teacher. Up to April 25, 1903, or 234 days, she received forty-six treatments, or about one treatment in five days. There was a marked decrease in the size of the tumor. From April 25 to August 29, 1903, she received only eight treatments, or one every two weeks. She had gained eleven pounds since the beginning of the treatment. From August, 1903, till May 20, 1904, she received only five treatments, or one every thirty-seven days. By this time her weight had increased to 147 pounds, being nineteen pounds more than in the beginning, and the tumor had entirely disappeared. In July, 1904, I examined the patient and was unable to detect any evidence of a tumor. The entire period of treatment extended over 849 days, during which time 136 treatments were given.

While it is true that only one year has elapsed since the cessation of the treatment and disappearance of the tumor, it is nevertheless the most remarkable case on record, I think, considering the very large size of the growth and its deep-seated location, although, of course, it is quite too soon to consider it a cure.

In a letter dated June 4, 1905, the patient states that she is in perfect health, and has had no return of the tumor.

In the last report of the Caroline Brewer Croft Cancer Commission of the Harvard Medical School, Vose and Howe present a careful *résumé* of the effects of the X-ray upon cancer, their investigations being based upon a study of 120 cases treated chiefly at the Massachusetts General Hospital of Boston.

In regard to deep-seated cancer, they fail to report a single case, carcinoma or sarcoma, that has thus far disappeared. They conclude that, being non-selective in its action, the X-ray cannot be used strongly enough to effect destruction in anything but the shallowest tumor without serious injury to the overlying tissue, or, in other words, producing such a burn as experience shows in all probability would never heal.

In regard to deep-seated cancer, they state that not a single case, carcinoma or sarcoma, has thus far disappeared. They conclude that, being non-selective in its action, the X-ray cannot be used strongly enough to effect destruction in anything but the shallowest tumor without serious injury to the overlying tissue, or, in other words, producing such a burn as experience shows in all probability would never heal.

Of late the use of the X-ray as a pre-operative measure has been strongly advocated by a number of men, especially by Dr. Morton, of New York. It is held that in cases of cancer in the early stages, particularly in small primary cancer of the breast, instead of advising immediate surgical intervention, the patient had better first be treated by the X-ray. The reasons for this plan are (1) that the X-ray treatment clears up the field of operation, *i.e.*, causing the glands in the axilla to subside or disappear and making the tumor itself smaller. If, at the end of four to five weeks of treatment, the growth has not entirely disappeared, an operation can then be performed, and performed under more favorable conditions than if the X-ray treatment had not first been used.

This plan of procedure I believe to be most pernicious and fraught with grave peril to the patient, if it should ever be considered seriously by the profession. The fallacy of such reasoning is twofold: (1) it presupposes that we are dealing

with a curative agent, and (2) it takes for granted that no harm can come to the patient by reason of the delay entailed in a trial with the treatment.

Now let us look at the facts: Has it yet been demonstrated that the X-ray is curative of cancer in any other form than the small superficial epitheliomas? As far as our own experience goes, extending over a series of 167 cases, and as far as can be judged from the published reports of the work of other men, there have been very few cases of deep-seated cancer, including sarcoma, that have disappeared under X-ray treatment; and there is at the present time no evidence that in a single case of deep-seated cancer in which the tumor disappeared, the patient remained well and free from a local or general return for a period of three years, the shortest time required to warrant us in speaking of a cure. On the other hand, we do know from experience that in practically all of the cases in which tumors have disappeared there has been a speedy recurrence.

This to prove that we are dealing with an agent that has given us no reason, so far, to call curative.

(2) The danger of postponing operative treatment until the X-ray has been tried is lost sight of. I have personally seen a number of cases of primary or recurrent cancer of the breast markedly decrease in size under X-ray treatment and, in some instances, altogether disappear at the very time when the disease was insidiously extending into neighboring glandular areas, the cervical or mediastinal glands, or was being carried by the circulation into the general system, giving rise to fatal metastases. In these cases the extension was so rapid that I believe the breaking down of the tumor tissue, which occurs before absorption takes place, carries with it the serious risk of some of the living cells getting into the circulation, thereby causing generalization of the disease. The experiments upon cancer in mice carried on by Drs. Park, Gaylord, and Clowes at the Cancer Research Laboratory in Buffalo tend to support this opinion.

The prolonged use of the X-rays in cases of recurrent

cancer of the breast, as well as in a number of cases of recurrent cancer of the tongue and lip, has shown practically little or no effect upon the invaded glands; they neither disappeared nor decreased materially in size.

Now suppose the X-ray treatment were tried for a few weeks before operation. Three things may occur:

1. The diagnosis may be quite uncertain without removal and microscopical examination of the tissue; hence, the result, if the tumor disappears and the patient remains without further trouble, cannot be put in the same category as a cure from operative treatment, in which the diagnosis has been confirmed by the microscope.

2. Granting the correctness of the diagnosis and the tumor disappears under the treatment, such a result, while possible, from our present experience, is extremely unlikely to occur. Of forty-three cases of malignant tumors, even including superficial epitheliomas, reported by Skinner, whose enthusiasm in behalf of X-ray treatment cannot be doubted, only three entirely disappeared, or 7 per cent.; and a much smaller percentage would be found if dealing with deep-seated cancer alone. Of my own breast cases, thirty-six in number, only one disappeared, and this was quickly followed by a recurrence and extension into lung.

If, however, the tumor should disappear, the patient, believing herself cured, returns to her home, and before any local recurrence has taken place the disease may appear in the axillary, cervical, or mediastinal glands, or there may be metastatic deposits in the lung or liver, thus placing the patient beyond help from either X-ray or surgery.

3. Suppose the growth to have diminished in size and then to have shown no further improvement. Such a case is said to be in better condition for operation than before the X-ray treatment. But is such the case? The very fact that the tumor has diminished in size or the glands are smaller would tend to restrict the field of operation and lead the surgeon to remove less tissue than he otherwise would have done. But above and beyond all other considerations, in my

estimation, is the fact that tumor degeneration caused by the X-ray carries with it the risk of living cancer-cells being carried into the neighboring glands and of entering the circulation, causing metastases.

The following case which has recently come under my observation, and which can, no doubt, be duplicated by many surgeons, furnishes striking evidence of the dangers to the patient in the pre-operative use of the X-ray in primary operable growths.

*Epithelioma of the Lip.*—A man, aged fifty years, noticed a small epithelioma of the lip in the spring of 1903, about the size of a small bean. He was advised to have X-ray treatment rather than operation, and after thirteen exposures the tumor had apparently entirely disappeared and the patient was discharged cured. Less than six weeks after this time, a local recurrence was noticed, when again the X-ray treatment was taken up. At this time the X-rays had apparently no effect upon the growth of the tumor, which continued to increase in size rapidly in spite of frequent treatments, and, finally, three months later he was sent to me for operation. His condition at this time was as follows: There was a typical ulcerating epithelioma involving more than half of the lower lip, and, in addition, the sublingual and submaxillary glands were extensively involved. I performed a very extensive operation, removing three-quarters of the lower lip and the glands as carefully as possible, but with little hope of radical cure. About six months later there was a recurrence in the cervical glands.

When we consider that epithelioma of the lip in its earlier stages furnishes the largest percentage of cures of any locality, about 50 per cent., it is fair to infer that in this case the patient's life was probably sacrificed owing to the loss of time incurred by the pre-operative use of the X-ray.

I have recently examined a man aged sixty years, who, about a year ago, was treated with the X-ray for a small epithelioma of the tongue, receiving fifty-two treatments in all, with the result that the disease now involves the entire

anterior half of the tongue, floor of mouth, submaxillary and sublingual glands, the growth being firmly adherent to the bone.

## CONCLUSIONS.

The results of the X-ray treatment of malignant tumors up to the present time have proven

I. That the X-ray exerts a powerful influence upon cancer cells of all varieties, but most marked in cases of cutaneous cancer.

II. In some cases, chiefly in superficial epithelioma, the entire tumor may disappear, probably by reason of fatty degeneration of the tumor cells with subsequent absorption.

III. In a much smaller number of cases of deep-seated tumors, chiefly cancer of the breast and glandular sarcoma, tumors have disappeared under prolonged X-ray treatment. In nearly every one of these cases, however, that has been carefully traced to final result, there has been a local or general return of the disease within a few months to two years.

IV. In view of this practically constant tendency to early recurrence, furthermore, in the absence of any reported cases well beyond three years, the method should never be used except in inoperable cases, or as a prophylactic after operation, as a possible, though not yet proven, means of avoiding recurrence.

V. The use of the X-ray as a pre-operative measure in other than cutaneous cancer is contraindicated, 1, because the agent has not yet been proven to be curative; 2, because of serious risks of an extension of the disease to inaccessible glands or to other regions by metastases during the period required for a trial of the X-ray.

# SCOPOLAMINE-MORPHINE AS AN ADJUVANT IN THE ADMINISTRATION OF GENERAL ANÆSTHESIA.[1]

BY MAJOR GABRIEL SEELIG, M.D.,

OF ST. LOUIS, MO.,

Associate-Surgeon to the Jewish Hospital; Assistant in Anatomy at the Medical Department of St. Louis University.

THE purpose of this paper is to present a series of sixty-five general anæsthesia administrations, showing that the method used is one that merits recommendation and trial. This series included the following range of cases: Abdominal Hysterectomy, 8; Vaginal Hysterectomy, 6; Herniæ, 5; Plastic Operations, 8; Operations in the Tubes and Ovaries, 11; Uterine Fixations, 6; Curettements, 6; Hæmorrhoids, 3; Fistula in Ano, 2; Thyroidectomy, Craniectomy, Orchidectomy, Appendicectomy, Costectomy, Nephropexy, Tumor of Breast, Cyst of Neck, Pelvic Abscess, Exploratory Laparotomy, one each. In every instance the patient received a hypodermatic injection of scopolamine hydrobromate, grain 1/100, and morphine, grain 1/6, one half-hour before the administration of the general anæsthetic. The general anæsthesia was induced by means of the ethyl chloride-ether sequence administered through the Bennett inhaler.

The Bennett inhaler was used because an experience of five years with it has assured the writer of its practicability, and because he finds disadvantages in all other inhalers. In the recently described inhaler of Iglauer,[1] for example, the anæsthetist is unable to administer ether or gas at will, after once having started the administration of ether. Ethyl chloride is substituted for nitrous oxide gas, because it is practically as safe, induces quicker anæsthesia, causes no cyanosis or asphyctic symptoms, and obviates the necessity of transporting bulky

[1] Read before the Medical Society of the City Hospital Alumni of St. Louis, May 18, 1905.

steel cylinders of the compressed nitrous oxide gas. Herrenknecht,[2] in a most extensive monograph, confirms the above statements. Gaudiana[3] reaches the same conclusions, and shows that not one of the few instances of death laid at the door of ethyl chloride was solely due to the drug itself. Danill,[4] the instructor in anæsthetics at the Royal Infirmary, says of the ethyl chloride-ether sequence, "the method certainly has some advantages over the gas-ether sequence, and is a most excellent one. I have never had reason to complain of it, either from the point of view of safety or for any other reason. The advantages of the ethyl chloride-ether sequence are practical ones."

In order to make the Bennett inhaler suitable for the administration of ethyl chloride, a slight modification was necessary. A piece of small-caliber brass tubing (length 3 centimetres, lumen 1.5 millimetres) was inserted about one-half an inch distally to the air-valve. This brass tubing is placed obliquely, so as to throw the ethyl chloride spray towards the rubber bag of the inhaler, thus insuring against any of the fluid reaching the patient's face. By means of a three or four inch piece of rubber tubing, a connection is made between the ethyl chloride container and the inhaler, through the brass tube. These details show clearly in the appended illustrations. As the ethyl chloride container hangs suspended from the brass tube, the rubber tube kinks and effectively shuts off the escape of any ethyl chloride gas. By one movement the flask of ethyl chloride is turned spout end down, and the rubber tube straightened out, so that a measured quantity of the fluid runs into the rubber bag. There is no frosting or freezing, and consequently no more chance for the much talked of "refrigeration of the lung" than there is with any other anæsthetic. The method really simplifies the Bennett inhaler, in that it does away with the large and cumbersome gas-bag. In this very simplicity the modification seems to possess a decided advantage over the more complicated one recommended by Pedersen.[5]

At this day there is certainly no occasion for a statement

FIG. 1.—Bennett inhaler, modified for the use of the ethyl chloride-ether sequence.

of facts justifying the use of ether as a routine general anæsthetic. It has been shown repeatedly during the last few years that the formerly much dreaded "postoperative pneumonia" is by no means solely referable to ether. Aspiration of mucus and vomitus, exposure, and pulmonary embolism have been pretty clearly demonstrated to be the predisposing factors of postoperative pneumonias; and no particular anæsthetic, not even local anæsthesia, does away with the danger of exposure, of embolism, or of vomiting. Moreover, experimental proof is gradually accumulating to show that ether is not the only anæsthetic that has an injurious effect on the kidneys. Kemp [6] showed, as early as 1899, that "renal complications may follow *any* anæsthetic, . . . for there is no known anæsthetic administered in any effective quantity, whatever the method of administration, which does not affect the renal circulation." Moreover, M. Jaquet,[7] in a comprehensive investigation of the comparative merits of chloroform and ether, shows that chloroform causes a parenchymatous degeneration of all the organs, whereas, ether produces no histological lesions; and this fact has been confirmed in a lately published research of Offergeld.[8] The latter author even shows that the parenchymatous degeneration induced by chloroform may be the cause of death some time after the administration of the anæsthetic.

Unfortunately, the physiology of artificially induced anæsthesia is not positively known. The important conclusions worked out by Overton [9] are generally credited as being correct, and are already finding their place in standard works on physiology. For the clinician, the important aspect of Overton's work is not so much the establishment of the doctrine that anæsthetics act by going into solution in the lipoids (fat, cholesterin, and lecithin) of cells, as the other fact, that the injury wrought in these cells is directly proportional to the quantity of anæsthetic used. It is probably fair to assume that not one operator in a hundred concerns himself with the quantity of anæsthetic administered to his patient. Yet we read in one of the latest published works on physiology [10]

that " cell death is caused by a prolonged anæsthesia." One of the ends to be aimed at in the administration of all the anæsthetics is to reduce the amount administered to a minimum. The ethyl chloride-ether sequence most positively aids us in the attainment of this end.

We are further aided, however, by the administration of scopolamine-morphine hypodermatically. Scopolamine is an alkaloid of hyoscyamus niger of the order of solanaceæ. Its sister alkaloids are hyoscine, daturine, duboisine, atropine, and hyoscyamine. Although much has been written concerning scopolamine (chiefly as a result of the investigations of psychiatrists and chemists), it still remains to be settled in just what particulars it differs from other alkaloids of the belladonna group. It is most closely related to hyoscine. Kunzel,[11] Steinbuechel,[12] Kochmann,[13] and others state that it is identical with hyoscine, whereas Ladenburg [14] claims to have shown that hyoscine and scopolamine are by no means identical. The best *résumé* of the physiological action of scopolamine is given by Steinbuechel.[12] He states:

1. Small doses *raise* blood-pressure by stimulating the vasomotor centre. Large doses lower it by influencing the cardiac excitomotor mechanism.

2. Pulse usually slowed a trifle, but is ordinarily not influenced by small doses. Large doses cause a vagus pulse.

3. Cerebral cortex rendered less excitable when stimulated by the faradic current. Sleep is induced, but not analgesia.

4. Respiration not influenced by small doses. Large doses slow respiration.

5. Sweat, mucus, and saliva secretion markedly diminished.

6. Mydriasis.

7. Motor end-apparatus supplying the intestine paralyzed. Tone of the splanchnic increased.

8. Excreted by the kidney.

Kochmann [13] states that there has never been a death attributable to scopolamine. Dogs react to the drug exactly

as do human beings, yet a dose of thirty grains, injected intravenously into a fifteen pound dog, does not kill.

In 1900, Schneiderlin [15] published the first paper advocating the use of scopolamine as a substitute for general anæsthesia by inhalation. Scopolamine itself does not induce analgesia, but combined with morphine it induces a state of general anæsthesia sufficiently profound to permit the performance of any operation. The method of administration and dosage was more carefully worked out by Korff [16] and Blos; [17] as a result of Korff's work, in particular, the following dosage was adopted: Scopolamine, 0.0012, and morphine, 0.025. This was divided into three doses, administered hypodermatically, three, one, and one-half hours before the operation. Schneiderlin, Korff,[18] and Blos all reported excellent results.

Rational objections were gradually advanced against a method of inducing anæsthesia by means of fixed dosage, one author even going so far as to pronounce the method useless and dangerous.[19] In addition, three unfortunate deaths occurred during and following operations on patients to whom scopolamine and morphine had been administered. These deaths, although not wholly referable to the anæsthesia, nevertheless served to place scopolamine-morphine narcosis in discredit. There it remained until Carl Hartog [20] suggested that both the scopolamine and morphine be administered in much smaller doses than was recommended by previous authors, and that ether be relied upon to complete the anæsthesia. Hartog reported seventy-five cases, and spoke of his results in most glowing terms. It was my good fortune to observe most of the cases he reported, and to be able to confirm all his statements.

Through the kindness of Drs. Gellhorn, Ehrenfest, Witherspoon, Bartlett, and Mudd, I am able to report a series of sixty-five cases in which scopolamine hydrobromate, grain 1/100, and morphine, grain 1/6, were administered half an hour before inducing general anæsthesia with ethyl chloride-ether. In more than half the cases the anæsthetic was admin-

istered by Dr. W. E. Leighton. As a result of my experience with the method, I feel that I may say without reserve that I have never seen results even approximating those that were obtained by this method. Unstinted praise always carries with it the suspicion of a somewhat biased critique. Yet, so exceptionally smooth were these narcoses that they warrant one's carrying the burden of this suspicion until it is proved unfounded. Of these sixty-five cases only one vomited or retched while on the operating table. Seventy-seven per cent. of the cases *did not vomit at all.* One-third of the cases that did vomit, vomited only once, and then only from two drachms to one ounce of clear mucus. Nausea was never pronounced, except in two cases, and vomiting never occurred earlier than two hours after the operation. This last fact is of supreme importance, for in all cases where vomiting did occur, laryngeal sensibility was intact, and acted as a complete safeguard against tracheal aspiration, and the consequent danger of an aspiration pneumonia. There is no occasion for dilating upon either the discomforts or the dangers attendant upon post-anæsthetic vomiting. They are well known. I can find no record of a series of general anæsthesia administrations followed even by approximately so small a percentage of vomiting, and if the preliminary administration of scopolamine-morphine did nothing else than lessen the liability to vomit, its use should be highly recommended.

But it does more. First of all, it markedly lessens the quantity of anæsthetic necessary. About four ounces of ether per hour of operation are used when the drug is administered skilfully and carefully. In a personal communication to me, Dr. T. L. Bennett, of New York, tells me that he uses about four ounces of ether per sixty minutes of anæsthesia, and that for a two-hour operation he requires about six ounces. This averages three and a third ounces per hour. We used barely a fraction over two ounces an hour. It has already been pointed out how great a desideratum it is to administer a minimal quantity of ether.

After the administration of scopolamine-morphine the

patients are in a peaceful state of mind, and go under the influence of the general anæsthetic without passing through the usual state of excitement. Salivation is almost invariably absent, thus adding another safeguard against aspiration pneumonia. After their return to bed the patients lie absolutely quiet and awaken without the slightest excitation. After remaining awake for a short period they usually doze off again, or at least remain quiet and peaceful. The first twenty-four hours following the operation is attended by much less pain and discomfort than in cases where the scopolamine is not administered. These advantages: lessened amount of anæsthetic necessary, absence of salivation, avoidance of the stage of excitement, marked reduction in the liability to vomit, and quiet and freedom from pain after operation have been confirmed by Tuffier,[21] of Paris, Israel [22] and Dork,[23] of Berlin, and by Robertson,[24] of our own country (Robertson used hyoscine instead of scopolamine).

There is no reasonable objection to the use of scopolamine hydrobromate and morphine in the doses recommended of 1/100 and 1/6 of a grain respectively. The recent experimental work of Crile [25] shows that morphine lessens the intensity of many of the afferent nerve impulses reaching the vasomotor centres, as the result of stimulation of the peripheral nerves, and thereby lessens the susceptibility to shock. Scopolamine exerts a distinct influence in raising blood-pressure, and thereby also aids in preventing shock. So, from the point of view of prophylaxis, the combination of the two drugs strongly recommends itself. Only he who has witnessed a series of ether administrations preceded by scopolamine-morphine injections can appreciate what a boon these drugs afford both to the patient and to the operator.*

* It must be added that the consensus of opinion is, that many of the irregularities in the action of scopolamine are referable to impure preparations of the drug. All the authors quoted are in accord that Merck's scopolamine is the most reliable preparation. Moreover, scopolamine hydrobromate does not keep well in solution; and, in order to avoid the constant preparation of fresh solutions, I have had Parke, Davis, and Company make up tablet triturates of Merck's scopolamine

hydrobromate in tablets of $^1/_{100}$ grains each. One of these tablets should be dissolved together with a one-sixth grain tablet of morphine and injected hypodermically thirty minutes before the administration of the general anæsthetic. Scopolamine may be used with advantage as an adjuvant to chloroform, as well as to ether.

## BIBLIOGRAPHY.


[1] The Nitrous Oxide-Ether Sequence by Means of a New Inhaler. S. Iglauer. The Cincinnati Lancet-Clinic, March 18, 1905.

[2] Herrenknecht. Ueber Aethyl Chlorid und Aethyl Chlorid Narkose. Dr. William Herrenknecht. Leipzig, 1904.

[3] Ethyl Chloride Narcosis. Gaudiana. Riforma Médica, January 29, 1904

[4] Mixed Anæsthetics. G. W. Danill. Edinburgh Medical Journal, February, 1905.

[5] An Attachment to Bennett's Inhaler. Victor Pedersen. New York Medical Journal, December 24, 1904.

[6] Further Experimental Researches on the Effects of Different Anæsthetics on the Kidneys. R. C. Kemp. New York Medical Journal, November 18 and 25, December 2, 1899.

[7] Semaine Médicale, December 7, 1904.

[8] Experimenteller Beitrag zur toxischen Wirkung des Chloroforms auf die Nieren. Offergeld. Archiv für klin. Chir., Band lxxv, Heft 3.

[9] Studien über die Narkose. E. Overton. Jena, 1904.

[10] Vorlesungen über Physiologie, p. 26. M. v. Frey. Berlin, 1904.

[11] Kunzel. Handbuch der Toxicologie. Jena, 1899. Page 714.

[12] Steinbuechel. Schmerzverminderung und Narkose mit specieller Berücksichtigung der kombinirten Skopolamin-Morphium Anæsthesie. Leipzig, 1903. Franz Deuticke.

[13] Th. Kochmann. Ueber die therapeutischen Indicationen des Skopolamin-Hydrobromicum. Therapie der Gegenwart, May, 1903.

[14] Ladenburg, quoted by Roith. Bemerkungen zur Skopolamin Narkose. Monatsch. f. Geburtshulfe u. Gynäk. Band xviii, p. 627.

[15] Schneiderlin. Aerztliche Mittheilungen aus und für Baden, No. 10, 1900.

[16] Korff. Münch. med. Woch., No. 29, 1901, p. 1170, and No. 27, 1902, p. 1133.

[17] E. Blos. Beiträge zur klin. Chir., Band xxx, p. 565, 1902.

[18] Korff. Berl. klin. Woch., No. 33, 1904.

[19] Flatau. Münch. med. Woch., No. 28, 1904.

[20] C. Hartog. Die Aethernarkose, in Verbindung mit Morphium-Skopolamin Injectionen. Münch. med. Woch., No. 46, 1903.

[21] Gazette Médicale de Paris, No. 8, 1905.

[22] Deutsche med. Woch., No. 10, 1905.

[23] Deutsche med. Woch., No. 10, 1905.

[24] Medical Record, January 9, 1905.

[25] Blood-Pressure in Surgery. George W. Crile. J. B. Lippincott Company.

# SCOPOLAMINE-MORPHINE ANÆSTHESIA.

## REPORT ON ITS USE IN SEVENTY-TWO CASES.

BY EMIL RIES, M.D.,

OF CHICAGO.

In May, 1900, Schneiderlin [1] first published his experience with a new method of general anæsthesia produced by the aid of a combination of scopolamine and morphine. Since then a number of reports have been published in Germany and Austria, but I am not aware that anybody has used the method to any extent in this country, or has given a report on it in the literature. As the method undoubtedly has great advantages, it will probably come into more extended use, and some words concerning my experience with it might prove of value to others who may wish to test it.

Scopolamine is an alkaloid extracted from the roots of scopolamina carniolica. It is closely related to hyoscine. According to some authors, hyoscine and scopolamine are identical, or at least isomeric; while others state that hyoscine always contains scopolamine and is not a pure alkaloid.

However that may be, it is pretty certain that scopolamine, though it is produced and sold in crystals, is unstable and not absolutely uniform in its composition.

Kochmann [2] states the following effects of scopolamine, which interest us here.

1. Small doses increase the blood-pressure in consequence of irritation of the vasomotor centre; large doses decrease blood-pressure considerably, damaging the excitomotor apparatus of the heart.

2. The pulse is not changed by small doses; after large doses, in consequence of irritation of the vagus, the pulse becomes less frequent and its elevations become greater.

3. The excitability of the cortex of the brain by faradic currents can be decreased by scopolamine.

4. Hyoscine and scopolamine produce in man sleep, even in small doses. The sleep is preceded by restlessness. Analgesia during the sleep does not exist.

5. Respiration is not damaged by therapeutic doses. Large doses damage it.

6. Secretion of saliva, perspiration, and mucus are stopped by scopolamine.

7. Applied locally, and after absorption, scopolamine is a mydriatic and paralyzes accommodation.

8. Scopolamine is excreted through the kidneys.

9. The fatal dose of scopolamine is unknown. Injection of 0.09 scopolamine intravenously did not produce death in a dog.

Schneiderlin, like other alienists, had used scopolamine in his work in an insane asylum for the production of sleep in restless patients, and had then combined it with morphine in order to produce surgical anæsthesia for operations necessary on his demented patients. He expected to counteract the evil effects of morphine, particularly with regard to blood-pressure and pulse, by combining scopolamine with morphine, and his theoretical construction proved successful in his practice.

The greatest difficulty has since been found in determining the best proportion of the two drugs. If too much morphine is given, the effect on the heart becomes dangerous. If too much scopolamine is given, a state of excitement is produced similar to that following atropine poisoning. The patients become restless. It is difficult to keep them quiet. They talk as if in a delirium. The pupils are widely dilated and rigid, and the face is flushed. The patients demand water constantly and complain of dryness, but the excitement soon wears off, and neither in man nor in dogs have any cases become known where scopolamine alone has produced death. I have experimented on a dog of some eight pounds, to whom I gave fifteen times the dose we use on human beings, and, if I figure pound for pound, 225 times the dose we use on human adults of average weight, and it did not affect the dog's health at all.

In dosage and proportion, I have followed Korff,[3] who

published his experience with 200 cases. He gives one-tenth milligramme scopolamine and 25 milligrammes of morphine. This amount is divided in three doses, which are injected two and a half, one and a half, and one-half hour before the operation. He states that these doses are without danger, but that their effect varies in different individuals. The injection is given hypodermically in any part of the body. He thinks that if this dose does not suffice, larger doses ought not to be given, but chloroform or ether should then be used.

It is seen, therefore, that scopolamine-morphine is used for two purposes: first, with the intention to perform the whole operation under this anæsthesia alone; secondly, as a preliminary to anæsthesia by inhalation of chloroform or ether.

If the case is a complete success, the patient becomes sleepy after the first injection, is fast asleep after the second, and unconscious and insensible to pain after the third. Most of the patients do not even feel the third injection. The operation may then begin one-half hour after the last injection, and can proceed for hours without any other anæsthetic. The patients lie on the table with eyes closed or open, and do not move or react in any way. The pulse is often rapid, up to 120; sometimes very slow, down to 40. Respiration is quiet, and there is none of that disagreeable and dangerous accumulation of mucus in the mouth. The pupil is rigid, either dilated or contracted. The muscles are relaxed. The blood which escapes during the operation is of natural color. After the operation is finished, the patient is returned to the bed still unconscious, and continues to sleep for about five hours after the last injection. There is no retching or vomiting, and when the patient wakes up, food can be given immediately. For about one day the patient has a sensation of dryness in his mouth. There is no interference with the union of the wound or the peristaltic action of the bowels. The patient remembers nothing of the operation, goes to sleep in his bed, and wakes up usually unconscious of the fact that he has been operated on, and incredulous when he is informed that it is all over.

Thus the ideal course of a scopolamine-morphine anæsthesia. If they were all like that there would be no further need of discussions. But this ideal course partakes of the nature of all ideals in that it is frequently unattainable.

It is true that all patients whom I have seen go to sleep after the injection; but that sleep may be such a light one that they wake up when spoken to or moved, so that no manipulation is possible without rousing the patient. Some patients, even if aroused, cannot answer intelligently, but mumble a few unconnected words. Others wake up sufficiently to give correct answers. Others again, though they cannot be roused, move when being handled, or even complain.

Then it becomes necessary to add some other anæsthetic to the scopolamine-morphine. Ether and chloroform have been used by the European operators, and I have added infiltration anæsthesia with 0.6 per cent. salt solution without cocaine, which I have used in a number of cases successfully to the complete exclusion of chloroform. When chloroform is administered, very small quantities have to be used, and in many cases after the first few drops have been given, for the first incision, no more chloroform need be used, so that operations lasting fifteen or thirty minutes can be finished with less than a teaspoonful of chloroform. When the patients are not completely anæsthetized by the scopolamine-morphine, the same observation can be made as when operating without any or only with infiltration anæsthesia. Some organs are sensitive; some are not; some more so than others. The relaxation of the muscles may be more or less complete. While Korff [3] reports that he could reduce a dislocation of the shoulder with scopolamine-morphine alone, others emphasize, and that is my experience also, that scopolamine-morphine does not, as a rule, produce complete relaxation of the muscles, so that, for instance, in certain abdominal sections, where the recti muscles have to be held apart, it is necessary to add chloroform to the scopolamine-morphine.

It is noteworthy that even when chloroform has to be added to scopolamine-morphine, the latter still proves of great

value. First, there is no or hardly any excitement. Secondly, very little chloroform is needed, as stated above. Thirdly, the vomiting is very much reduced or entirely absent. Fourthly, the patients sleep for hours after the operation, and get over the disagreeable postoperative stage without any disturbance. Complete amnesia of everything connected with the operation, from the time the second dose of scopolamine-morphine has been given, is generally observed, so that even patients who appear wide awake, or who resist now and then during the operation, do not remember anything about it, or even refuse positively to believe that the operation is finished.

Scopolamine-morphine has been used in a wide range of operations. I have used it myself so far on seventy-two patients in ninety-two operations. The following is a list of the operations performed. The number of operations is greater than that of the patients, because in a number of cases several operations were performed at the same time, for instance, appendectomy and femoral hernia, cholecystostomy and nephropexy, plastic operation on the vagina, curettement and ovariotomy, etc.:

Amputation of breast, 1; amputation of thigh, 1; appendectomy, 12; appendiceal abscess, 2; cholecystostomy, 1; colostomy, 1; curettement, 8; cystoscopy, 3; extirpation of carcinoma recti, 1; extirpation of carcinoma uteri, 1; extirpation of goitre, 3; extirpation of testicle, 1; extirpation of tubercular glands, 2; extirpation of tumor of chest wall, 1; extirpation of urethral caruncle, 1; operation for stenosis of cervix, 1; hæmorrhoids, 6; abdominal hysterectomy, 5; vaginal hysterectomy, 3; laparotomy for pus-tubes, 2; nephropexy, 1; nephrotomy, 1; plastic operations on vagina, 14; prostatectomy, 1; radical operation for ventral hernia, 2; for inguinal hernia, 10; for femoral hernia, 1; vaginal celiotomy, 3; vaginal ovariotomy, 1; varicose veins of leg, 1; ventrofixation, 1; total, 92.

Of these seventy-two cases, three have died. A carcinoma of the uterus died from hæmorrhage due to laceration of the iliac vein in dissecting off adherent enlarged lymphatic glands.

The case of carcinoma of the rectum, in which the affected portion of the rectum was torn into during the operation, died of peritonitis five days after the operation. The case of prostatectomy, a very bad case of an old man in a septic condition, who was very anæmic in consequence of repeated severe vesical hæmorrhages and who had the largest prostate I have ever seen (much larger than a fist), died some six hours after the operation. In none of these cases can I accuse the scopolamine-morphine.

In the literature on scopolamine-morphine, a number of deaths have been reported as due to the scopolamine-morphine; but it seems to me with very little justification. The only case that seems to be due possibly to the scopolamine-morphine is one reported by Flatau,[4] in which, after an easy and uneventful operation on a submucous fibroid, the patient, who was exsanguinated by previous hæmorrhages, succumbed six hours afterwards. Her pulse grew weaker and weaker, became intermittent, Cheyne-Stokes respiration was observed. Post-mortem was not performed.

In all the other cases that have been reported, it seems to me entirely unjustified to accuse the scopolamine-morphine.

A number of these fatal cases may have been due to the large doses of morphine which Blos[6] had recommended, but which I have never used. Favorable reports are given by Volkman[7] on 20 cases; Bonheim[8] on 70 cases; Wiesinger[9] on 200 cases; Hartog[10] on 143 cases; Grevsen[11] on 69 cases; Semon[12] on 52 cases, a total of 554 cases.

In only two cases have I given a dose of morphine larger than above indicated. In one case a patient on whom I had operated for a large goitre with scopolamine-morphine was operated on a week later for a large ventral hernia. While the first time she had slept through the whole operation, she was not completely asleep before the second operation, and I gave her an additional 0.015 morphine. The operation was then completed without any chloroform. It lasted sixty-five minutes, and towards the end the patient was sufficiently awake to talk with her friends, and did not interfere with the operation in any way. In another case, in a very big woman with endo-

metritis and descensus of the vagina, the patient also was not completely asleep before the operation, and I gave her an additional 0.015 morphine. But the patient, though asleep during the operation, moved her legs repeatedly, so that we added 9 cubic centimetres of chloroform for the operation, which lasted thirty minutes. In both cases the pupil, before the extra amount of morphine had been given, was dilated, showing a preponderance of the scopolamine, and I therefore risked the additional amount of morphine.

The effect of hyoscine is so much like that of scopolamine, that my first cases on which I operated with hyoscine before I obtained the scopolamine, have had exactly the same course as those operated on with scopolamine. And excision of a urethral caruncle, a vaginal hysterectomy, a radical operation for inguinal hernia were performed without a drop of chloroform, and such operations as appendectomy, ventrofixation, and excision of hæmorrhoids on one patient, radical operation for unilateral or bilateral inguinal hernia on a second and third, appendectomy on a fourth, vaginal radical operation for double pyosalpinx on a fifth, vaginal plastic on a sixth patient were performed with such small quantities of chloroform as 9, 15, 5, 5, 25, 6 cubic centimetres of chloroform respectively.

It has repeatedly been noticed that hysterical patients or patients very much afraid of the operations would respond less completely to the scopolamine-morphine as well as hyoscine morphine. Blos,[6] in fact, goes so far as to say that hysterical patients usually become excited under the scopolamine-morphine. This, however, has not been the general rule in my cases.

The amount of chloroform necessary depends not only on the patient, and his reaction to the scopolamine-morphine, but, and not the least, on the anæsthetizer. Our interne, Dr. Fulton, who has watched the anæsthetic in the cases reported here, has become so expert in the use of chloroform that a very few drops of chloroform, 1 to 5 cubic centimetres, suffice now where at first 15 to 25 cubic centimetres would be necessary. The educational value of scopolamine-morphine in teaching econ-

omy in anæsthetics is, I think, not the least important point in its favor.

Scopolamine, when dissolved in water, does not keep long, and it has been our rule to have a new solution made every week. It has repeatedly been noticed that the effect of the scopolamine would decrease towards the end of the week. In the future, we shall have a new solution made every three days. We have always injected the scopolamine and morphine mixed together. I do not know as yet whether the effect of scopolamine-morphine injected separately, even if at the same time, will be different. Experiments in this direction are now under way.

## LITERATURE.

[1] Schneiderlin. Aerzt. Mitteil. aus und für Baden, May, 1900.
[2] Kochmann. Ther. der Gegenwart, May, 1903.
[3] Korff. Berl. klin. Wochenschr., 1904, 882.
[4] Flatau. Münch. med. Wochenschr., 1903, 28.
[5] Bakes. Arch. für klin. Chir., 1904, vol. lxxiv, p. 967.
[6] Blos. Bruns. Beitr. zur klin. Chir., vol. xxxv.
[7] Volkman. Deutsche med. Wochenschr., 1903, 967.
[8] Bonheim. Ibid., 1904, vol. xxx, p. 1133.
[9] Wiesinger. Ibid., 1904, p. 1335.
[10] Hartog. Münch. med. Wochenschr., 1903.
[11] Grevsen. Ibid., No. 32.
[12] Semon. Ibid., p. 1231.

# HYPERTROPHIC PYLORIC STENOSIS IN THE INFANT.

BY J. M'GREGOR ROBERTSON, M.D.,
OF GLASGOW, SCOTLAND.

THE following case affords material for a critical consideration of several points of great significance in the evolution of the clinical history of pyloric stenosis in infants, what is commonly called congenital pyloric stenosis, but the term "congenital" implies a theory, and would be better discarded.

The child was the first-born of its parents, two young people who had always enjoyed excellent health. The child was born at full time, was of the average size, and in all respects was a plump, healthy-looking infant, a male. It was nursed by the mother, and for the first six weeks thrived exceedingly.

On the day on which he completed his sixth week of age, he began to put up a little now and again after a drink. The vomiting was sudden, and the material was ejected *en masse* with force, sometimes apparently part only of what he had taken, sometimes what seemed the whole, and sometimes there was put up after a meal what seemed the amount of two drinks. Day after day the tendency to put up, after a drink, a portion or all of the meal increased. He was at the time in the country, and I did not see him till ten days after the commencement. He was then still plump and healthy, but he had, his nurse said, lost considerably. At that time there was nothing else she had to note except the persistent ejection after a drink of a portion or all of the milk, always with the same explosive suddenness and force.

I stripped him naked and examined him carefully, and could find nothing of a definite character. To the local practitioner, however, I expressed the opinion that there was a suggestion of three nerve phenomena: (1) A sluggishness of pupils, (2) a faint rigidity of the muscles of the neck, (3) a tendency to turn the eyes downward. The suggestion was so slight that one could not insist on its presence, but later these symptoms became quite distinct.

The child, failing to improve, was brought back to town a

week later, nursing was discontinued, and he was fed by means of a spoon with a milk mixture in very small quantities. At this date he was eight weeks old exactly; he had lost considerably, though he was still not ill-nourished. The temperature in the bowel had been always normal, but on the sixteenth day from the commencement of the vomiting, it reached 100° F. in the rectum; the pulse was 105 and occasionally intermittent; the respiration was normal, and the pupils reacted slowly to changes of light.

A period followed, occupied by attempts to feed without inducing vomiting, by the use of very small quantities, frequently repeated, of milk mixtures peptonized of various dilutions, Carnrick's food for infants, white of egg in water, etc., being given each a fair trial, and in this way several days passed without much being lost. Thus on the twenty-second day of the illness nothing was vomited for twenty-four hours, twelve ounces of fluid having been given. In the interval between the sixteenth and twenty-second days an effort had been made to substitute rectal for gastric feeding wholly for a period, nothing but water being given by the mouth. But this had to be abandoned, the rectum proving fully as irritable as the stomach, very nearly, indeed quite, intolerant.

During this period, also, an analysis had twice been made of the gastric contents, obtained by the vomit being caught in a clean vessel.

The characters of the vomit were these: an extremely viscid, semigelatinous fluid, white in color, slightly frothy in appearance. It moved like a gelatinous mass in the glass vessel when it was shaken. It was very sour to smell and acid to litmus. The total acidity equalled 17 cubic centimetres decinormal solution to 100 of the filtered contents, and these 17 cubic centimetres were represented as follows:

| | | Cubic Centimetres. |
|---|---|---|
| Free HCl | = | 0.00. |
| Acid salts | = | 10.00. |
| Free organic acid | = | 5.00. |
| Organic HCl | = | 2.00. |
| | | 17.00. |

A sample obtained a day or two later was so gelatinous that it would not filter. Because of the total absence of free HCl,

a mixture containing 0.2 per cent. HCl was given, and under its influence the vomit lost its remarkable viscosity.

Dilute peptonized milk seeming to be retained better than other foods, it was resumed in small quantities gradually increased, till two ounces in spoonfuls could be given within half an hour, and this repeated every two hours with little loss. Meanwhile, however, the temperature behaved in an erratic manner. On the twenty-fourth day, for instance, it was as follows: 4 A.M., 102°; 8 A.M., 102.3°; 12 noon, 100.4°; 6.30 P.M., 100.7°; 8 P.M., 99.3°. On the following day it was never above normal, and was taken in rectum every four hours.

On the twenty-sixth and following days it was as follows:

| Twenty-sixth. | Twenty-seventh. | Twenty-eighth. | Twenty-ninth. | Thirtieth. |
|---|---|---|---|---|
| 4 A. M..... 98.3° | 100° | 100.3° | 99.4° | 103.2° |
| 8 A. M.....103° | 98.4° | 101.2° | 99.4° | 103.2° |
| 12 M. .....101.3° | 97.3° | 100.3° | 100° | 101.3° |
| 4 P. M.....101.2° | 98.4° | 100.2° | 99.2° | 99° |
| 8 P. M..... 99.4° | 98.4° | 98.6° | 98.4° | 98° |
| 10 P. M..... | ..... | ..... | 102° | ..... |

From the sixteenth day of illness to the thirtieth day, the chief facts had been (1) the vomiting of more or less food, sometimes little, sometimes much, occurring from once to three or four times in the twenty-four hours, always with the same explosive force; (2) the erratic temperature; (3) elusive suggestions of nerve symptoms such as already noted. In appearance the child varied in an extraordinary way,—at one time being apathetic, pale, and pinched, with dark rings round the eyes, the eyes themselves dull and listless, with sluggish pupils; at other times he would appear fresh colored and bright, eyes alert, obviously taking notice, pupils freely mobile and expressive. An access of gastric irritability was usually preceded by the child becoming quiet, white, and haggard looking; then would follow the ejection of some food, after which his color and animation might return.

I have already commented on the irritability of rectum which made it impossible to substitute even for a season rectal for gastric feeding. The pharynx was equally irritable. In the course of the period under review repeated examinations were made of

chest and abdomen in general to assure oneself that nothing was being overlooked. If in such an examination any attempt was made with a spoon to depress the tongue, the stomach was immediately evacuated. The pharynx was always clean, but also always hyperæmic. Similarly, palpation over the epigastrium immediately caused vomiting, but up to the thirtieth day of illness no dilatation nor other abnormality had been made out, though repeatedly looked for.

During the whole of this period the child was kept lying on an ordinary single bed, from which he was lifted only for necessary purposes, and he was watched day and night. On the twenty-eighth day he was dull, apathetic, and quiet; his eyes showed a tendency to double external strabismus. His respiration, hitherto regular, assumed a Cheyne-Stokes character, in groups of three or four. The pulse at the time was 134 and the respirations 20 per minute. The rigidity of muscles of the back of the neck was quite obvious.

Towards the end of this period constipation began to be noticeable, what was passed from the bowel containing extremely little fæcal matter and being mainly dark, bile-stained mucus.

On the thirtieth day he was seen by Professor Stockman, when for the first time palpation over the epigastric region failed to induce vomiting. Vomiting had been so inevitable and immediate a sequel of any attempt to palpate the stomach, that as soon as Dr. Stockman began to palpate he was spontaneously warned by the mother of what would happen, and when it failed to happen, he was immediately informed by both nurse and mother, without any suggestion of mine, that an attempt to examine in this way had never before failed to provoke evacuation of the stomach. I lay stress upon this point because for the first time also bulging of the stomach was obvious, and for the first and only time gastric peristalsis was visible. In short, only when the stomach failed to empty itself quickly after a meal was there a suggestion of dilatation and of peristalsis, and this was not till the thirtieth day after vomiting had begun, when the child was, in other respects, also failing visibly. On this day, however, no tumor could be felt, but only once had a small quantity been ejected, and that only apparently because of castor oil, while sixteen ounces of fluid had been imbibed.

For a couple of days after this little nourishment was lost,

but a day later—the thirty-third of the illness—I detected on palpation a thickening in the region of the pylorus, and decided to have a surgical opinion. The pylorus could not be felt; the stomach seemed large; but when a No. 10 soft rubber catheter was passed, the stomach was found quite empty but for a little clear, viscid mucus. It was washed out with normal saline, and the returned fluid was quite free from odor, and contained only a plug or two of thick mucus. The child, however, was looking extremely ill; temperature in rectum was 104° F., and pulse 148; the surgeon did not think there was the smallest hope of an operation having a successful issue.

The following evening the child had a convulsive seizure, which recurred within an hour, and continued to recur at intervals of an hour and sometimes less for the next twenty-two hours, till operation was performed. The operation was undertaken in response to the request of the mother, who had done a large part of the nursing, had followed with great intelligence the various phases of the illness, and realized how hopeless the situation had become unless surgical interference could find some way of escape.

Contrary to expectation, the child bore the operation without difficulty, and took the chloroform easily; in fact, breathing and pulse improved under it.

The whole gastric wall was found to be uniformly hypertrophied, though dilatation was not marked, and the extreme pyloric thickening made clear the true nature of the disease. A gastro-enterostomy was performed, but under great difficulty, the duodenal wall being extremely thin and the lumen small. The gastric mucosa was very hyperæmic and highly sensitive, the act of introducing a small gauze plug through the wound in the gastric wall inducing a violent pharyngeal reflex, repeated when the gauze was withdrawn. The internal surface of the stomach wall was coated with a thick layer of transparent mucus, of high viscosity, to which I was subsequently disposed to attribute, in part at least, the failure of the operation.

The child survived the operation fourteen hours. Immediately after the operation the temperature stood at 96° F. in the rectum, but it rose to 99° F., and was at 98.8° F. shortly before death.

Convulsive attacks remained in abeyance for six hours after

operation, but then recurred repeatedly, and death was preceded by a severe one. Vomiting also was frequent in the interval between operation and death. A post-mortem was not permitted, but I was allowed to remove the stomach through the operation wound, and I removed it without disturbing the short circuit.

When a glass tube had been tied into the cardiac end, and the stomach was filled with water, it remained full, apparently not a single drop leaking through the pylorus. The photograph (Fig. 1) gives a very accurate view of the appearance of the organ when so distended. Fig. 2 shows the stomach opened up longitudinally, and reveals the distribution of the hypertrophy; the extremely narrow channel through the pylorus left patent by the hypertrophy was occluded by the rugæ and the dense secretion, and the outlet the operation meant to provide was similarly obstructed by viscid mucus. The operation, therefore, had secured only a brief relaxation of the extreme irritability of the stomach, but no actual outlet had been obtained. Fig. 3 is the photograph ($\times$ 6 diameters) of the hypertrophied pylorus, the hypertrophied portion passing into stomach on the right and duodenum on the left, the mucous surface being uppermost. An X on Fig. 2 shows the part from which this section was removed. The section was stained in picrocarmine, and Fig. 4 is a drawing of the left hand extremity of Fig. 3, where pylorus projects into duodenum.

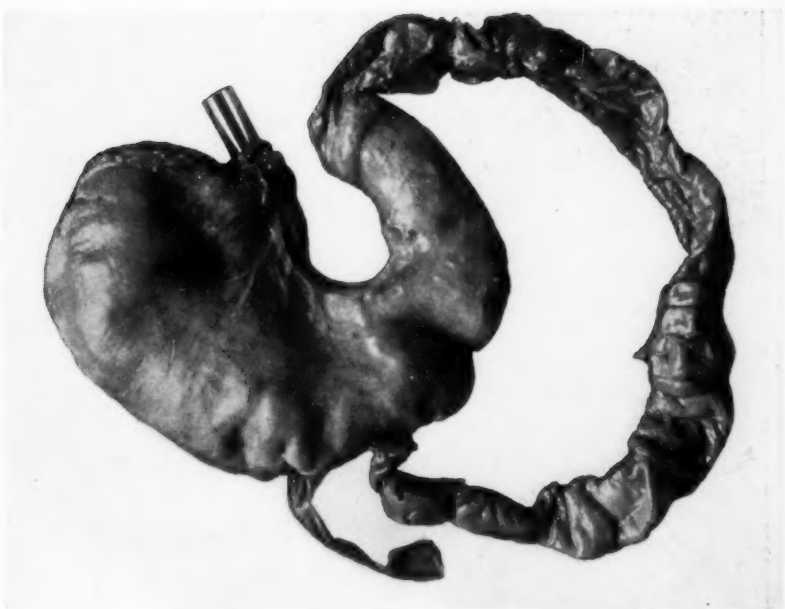


FIG. 1.—Infantile pyloric stenosis. Appearance of stomach removed post-mortem and distended with water.

FIG. 2.—Infantile pyloric stenosis: Longitudinal section. Congenital section. Note hypertrophic thickening of wall of pylorus indicated at ×, from which point tissue shown in Figs. 3 and 4 was taken.

FIG. 3.—Congenital hypertrophy of wall of pylorus. × 6 diameters.

FIG. 4.—Gastroduodenal junction. × 12 diameters.

# COMBINED VOLVULUS AND HERNIA THROUGH A RECENT MESENTERIC SLIT.

## RESECTION OF FIVE AND ONE-HALF FEET OF INTESTINE; DEATH ON NINTH DAY.

BY H. C. CURL, M.D.,

Passed Assistant Surgeon, United States Navy; Surgeon, Colon Hospital.

A MUSCULAR colored man, aged forty years, was admitted to the Colon Hospital, Isthmian Canal Commission, during the afternoon of March 1, 1905. Patient gave a history of perfect health up to seven o'clock that morning, when he began to have acute abdominal pain, referred to the umbilicus, severe in character, and changing from intermittent to constant. He had been engaged in some light work at the time the pain began, and no history of strain or heavy lifting could be secured. Vomiting had occurred once (about noon), and the bowels had not moved, not even gas passing per rectum. Eructations of gas occurred at infrequent intervals. At 5 P.M., when examined, the pain was less severe than it had been earlier in the day, and periods of comparative comfort were experienced; the patient's expression, however, was anxious, and the face was often covered with perspiration. There was no history of errors of diet nor of previous abdominal disease. Temperature, 98° F.; pulse, 62, and quite good.

Examination of the abdomen showed slight rigidity of recti, but very little resistance to deep, firm pressure; no tumor and no active peristaltic movements could be felt. The question of operation was considered, but it was decided that the symptoms did not warrant such a procedure at that time. An enema failed to secure more than a very small amount of fæcal matter, evidently from the lower bowel; there was no blood. Nothing was given by the mouth and stimulation was secured by hypodermics.

During the night there was moderate pain, and the temperature rose to 99.5° F.; pulse, 85. An examination made early the next morning revealed a very different picture from that of

the night before. The abdomen was tense, tender, and resistant; a mass could be plainly felt in the lower right quadrant, and no bowel movement had taken place. The general condition was not good. A "provisional" diagnosis of volvulus having been made, an immediate operation was prepared for. The patient reached the operating table about nine o'clock.

*Operation.*—Section was through the right rectus over the mass. On reaching the peritoneum, this was seen to bulge strongly outward, and, on being opened, a jet of foul-smelling, dark fluid spurted from the abdomen. A large knuckle of black intestine lay immediately below the incision, and, after freeing the cavity of fluid, it was delivered. It appeared to be a simple volvulus, and was partially untwisted. There remained, however, a considerable portion of it which could not be so freed, and it was soon discovered that this consisted of a mass of intestine which had forced itself through a recent rent in the mesentery and had become strangulated (Fig. 1). As the entire mass was black and without circulation, a resection was done; five and a half feet of the lower ileum were removed and an end-to-end anastomosis done with fine silk, no Murphy button being available. The anastomosis was within an inch of the ileocæcal valve, and the appendix, lying in close contact with it, was removed. The abdomen was partially closed after thorough irrigation with salt solution, and several gauze strips were left in for drainage.

The patient reacted well from the operation, and on the fourth day had a large semisolid stool. Similar movements occurred on the fifth and sixth days. The drainage strips were removed on the fourth day, and, until the evening of the seventh day, the temperature was not above 99° F., and the general condition was good. The pulse, however, remained rapid, only dropping to 90 on one occasion. Nutrient enemas were retained, and there was no nausea.

The pulse became weaker, and death occurred on March 10, nine days after operation, from general peritonitis.

The case was of special interest because of the comparatively slight reaction on the first day, and the unusual combination of a volvulus and a large mass of intestine strangulated through a mesenteric rent, evidently of recent origin, and occurring without a history of any strain or trauma to cause it.

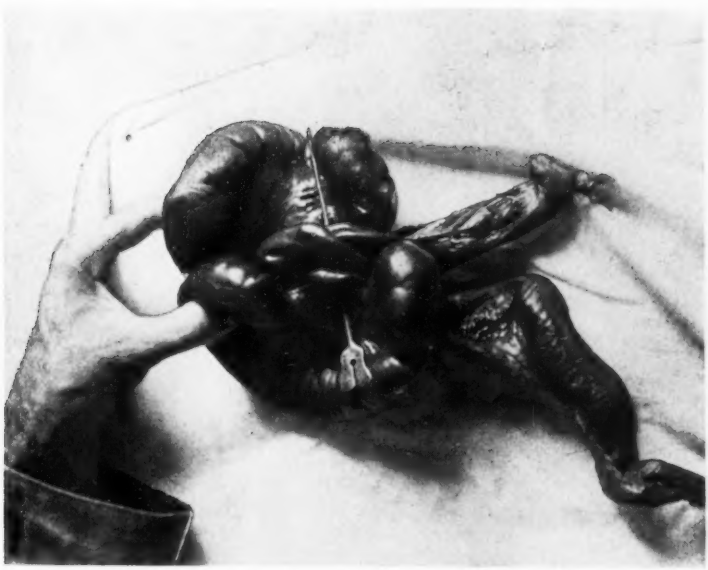


FIG. 1.—Knuckle of intestine herniated through rent in mesentery, and strangulated; director passes through the mesenteric opening.

# THE CURE OF FEMORAL HERNIA.[1]

## RESULTS OF ONE HUNDRED AND TEN OPERATIONS BY A SINGLE METHOD.

BY WILLIAM BURTON DE GARMO, M.D.,

OF NEW YORK,

Professor of Special Surgery (Hernia) in the New York Post-Graduate Medical School and Hospital.

THIS title has been chosen as indicating a fairly large number of femoral hernias to have been operated upon by a single method, and by the same operator. Also, as indicating that a variety of methods are used by different operators, or even by the same operator.

It is only fair at the outset to state that any method that clears the femoral canal completely of all displaced tissue, and that constricts the femoral opening with a suture that is not too quickly absorbed, will be pretty sure to be attended by a fair amount of success.

As the operation to be described has been used by me for fifteen years, since March 4, 1890, in 110 cases with only one actual recurrence, it seems worthy of record. Its perfect simplicity and ease of performance would also make it seem desirable that it should be more generally known. While I have taught it during all of these years to my classes at the Post-Graduate Hospital, it has remained unpublished. It is so simple as to readily suggest itself, and undoubtedly has been used by many operators, both before and since I began it.

The cases here recorded have been met with in operating upon a series of 1250 abdominal hernias. The 110 femoral hernias were in 99 patients, 83 of whom were females and 16 males. Eighty-eight patients had single and 11 had double femoral hernia.

---

[1] Read before the Surgical Section of the New York Academy of Medicine, May 5, 1905.

Of the single hernias, 59 were on the right side and 29 on the left. One patient had double femoral hernia and left inguinal. Three had double inguinal and single femoral hernia. Two had single femoral and inguinal hernia on the same side, making five cases who had femoral and inguinal hernia on the same side. Six had femoral hernia on one and inguinal on the opposite side.

In 28 patients, strangulation of the hernia existed at the time of the operation, and 82 were operated upon for the cure of the hernia.

The ages were, 4 under 10 years of age; 6 between 10 and 20 years; 18 between 20 and 30 years; 34 between 30 and 40 years; 15 between 40 and 50 years; 11 between 50 and 60 years; 5 between 60 and 70 years; 5 between 70 and 80 years; 1 over 80 years.

The youngest patient was eight years of age and the oldest eighty-one years. The latter was operated upon in a private house, in the middle of the night, for femoral hernia of enormous size that had existed for thirty years and which had been strangulated for six hours. She lived nine years after the operation, during which time she wore no truss and had no recurrence.

*Mortality.*—In the entire number only one death has occurred, and that was an old woman of seventy years, who had suffered from strangulated hernia for three days, during which time she had been subjected to the most violent attempts at reduction. Perforation of the bowel was found, and, owing to the moribund condition of the patient, the intestine was fastened in the wound and freely opened. She died of exhaustion twenty-four hours later.

*Recurrences.*—In one case recurrence occurred three weeks after the operation from violent vomiting due to acute indigestion. This case was reoperated upon eight months afterwards, and has remained cured three years. One patient, a man, who had double inguinal and right femoral hernia, was supposed to have a recurrence of the femoral hernia. Upon reoperating, the protrusion was found to be subperitoneal fat that had slipped through under Poupart's ligament, but no

FIG. 1.—(Gray.) *A* showing small pocket by side of femoral vessels where hernia usually protrudes, breaking down Gimbernat's ligament and forming an elongated, triangular opening. The top of this triangle is Poupart's ligament, the floor the tissues covering the ramus of the pubes, its base the femoral vessels, and its point the spine of the pubes.

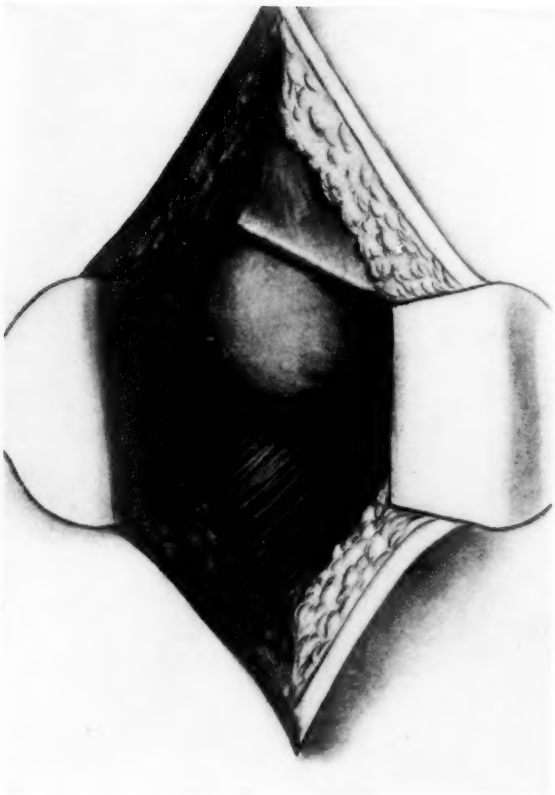


FIG. 2.—Showing protrusion under Poupart's ligament. The femoral vessels are to the outer side of the sac. The sac should have been shown with smaller neck.

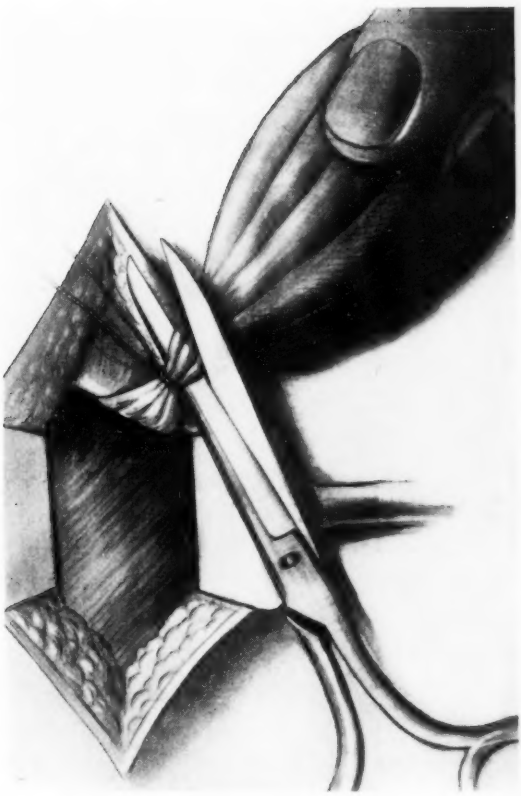


FIG. 3.—Sac forcibly drawn down while being ligated and cut away. This after examining its interior to see that no adhesions exist.

hernial sac had formed. In one other case, believed to be identical with the one just narrated, a woman of thirty-five years, had a small swelling in the femoral region nine months after operation. A light truss was applied and worn one year, and she has now been five years without support and no protrusion. It is believed that this also was a small protrusion of subperitoneal fat, and absorption was produced by truss pressure. I have never seen a femoral hernia cured by truss pressure, no matter how young the patient nor how small the protrusion.

One woman of seventy-five years of age had a recurrence within eight months of the operation, and, so far as I know, this is the only actual recurrence. By far the greater number of these cases have been traced and the permanence of the cure ascertained.

Three cases operated upon were recurrent following some previous operation, the character of which is unknown. All of these recurrent cases have remained cured for more than four years.

Two cases had by mistake been operated upon for inguinal hernia, when, in reality, femoral hernia existed, and it is a rather remarkable fact that both were operated upon by operators noted in other lines of surgical work.

*Contents.*—Contents of the hernias were in most instances intestine or omentum, or both. In one instance, a small and unhealthy ovary was found in the sac. In two cases of strangulation with quite acute symptoms, appendices epiploicæ were found strangulated. In these cases the bowel itself was held firmly against the femoral opening, but the lumen of the intestine was not constricted. Cysts in or around the sac were found in four cases.

In one case, the daughter of a well-known physician, strangulation was coincident with the first protrusion of the hernia. In stepping from a railroad-car, the step being much higher than she had estimated, a hernia was forced through the femoral canal, and at once urgent symptoms presented.

*Operation.*—The incision for the operation here described should be between two and three inches long, parallel with

and to the inner side of the femoral vessels. (Fig. 1.) The upper angle of the wound should be well up over Poupart's ligament and extend down over the saphenous opening. Many times the line of separation between the superficial fascia and the deep transversalis fascia, that has been pushed down in front of the peritoneum by the hernia, will be so distinct as to lead the operator to feel that he has the true sac. On cutting through this, however, he will come upon the subperitoneal fat (sometimes mistaken for adherent omentum) and then reach the bluish-white, true hernial sac. As in other locations when the true sac is opened, there is almost uniformly found evidence of the normal abdominal fluid and the shiny surface characteristic of peritoneum.

When the skin and the superficial fascia are incised, usually the sac and its subperitoneal fat will come into the wound with the appearance of an encysted lipoma (Fig. 2), and, before separating the sac, it is best that this entire mass should be lifted out of its bed by thumb forceps and blunt dissection, so that its neck where it passes under Poupart's ligament shall be entirely free from its surroundings. By traction on the sac (Fig. 3) and its superimposed fat, this neck may not only be freed, but it will be materially lengthened, so that when it is finally ligated and cut off it will retract within the abdominal cavity, leaving the femoral canal free of foreign tissue. This is absolutely essential to the subsequent permanent cure of the case.

The sac should be opened, and where omentum is found adherent it should be carefully ligated, cut away, and its stump reduced to the abdominal cavity. Adherent intestine will rarely be found, but where it is, the adhesions must either be broken up, or, if too firm, the adherent part may be cut out of the sac and left attached to the bowel. When in doubt, the latter method is by far the safer. Adherent omentum is frequently found, and should be cut away after careful ligation.

The sac, having been entirely freed of its contents, is tied off as high up as possible while it is being forcibly drawn down by an assistant. Great care must be used to insure the perfect

FIG. 4.—Blunt needle used in putting sutures in place.

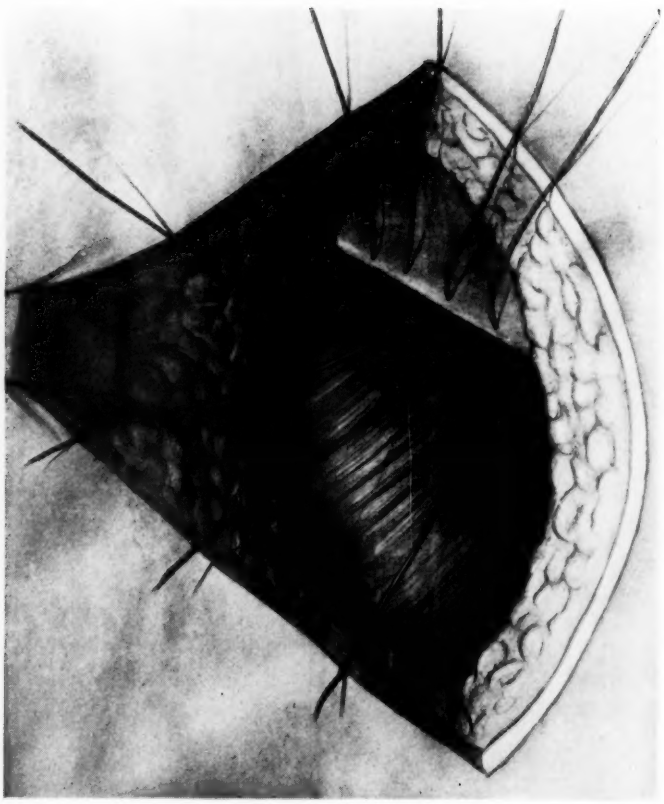


FIG. 5.—Showing sutures of kangaroo tendon passing through Poupart's ligament above and through all tissues to periosteum of ramus of pubes.

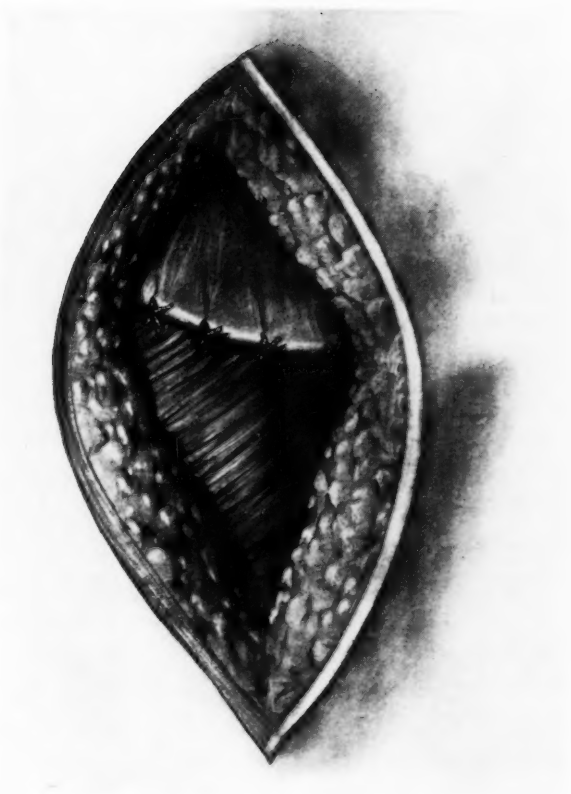


FIG. 6.—Showing depression of Poupart's ligament to ramus of pubes by sutures tied down.

freedom of the neck of the sac from protruding bowel or omentum while the ligature is being placed. After tying with strong catgut (a double strand of No. 2 plain is preferred), pass the needle, which has been previously threaded with it, through the neck of the sac and tie again. This gives a double ligature anchored by perforation between the two and prevents slipping off.

When the sac is cut away the stump should be examined to be sure that no bleeding vessels remain, and not until then should the ends of the ligature be cut. When the ligature is cut the stump usually retracts within the abdomen. If this is prevented by connective tissue which has not been broken, it should be carefully pushed back, leaving the femoral opening absolutely free.

This opening is closed in the following manner by good sized kangaroo tendon threaded in a strong blunt needle (Fig. 4). Press the end of the finger firmly into the femoral opening under Poupart's ligament, and pass the needle through the ligament upon the finger-point. This perforation should be well towards the outer side of the canal and close to the femoral vein. The operator should assure himself, by pressure of the finger against the ramus of the pubes, that the vessels are out of the way, and then pass the point of the needle fully down to the periosteum of the pubic bone, taking up all tissues over it. This constitutes the first stitch, but should not be tied until the others are in place. Others should then be placed in the same manner every quarter of an inch apart until near the spine of the pubes (Fig. 5). Usually three or four will completely close the femoral opening.

When tied down and the ends cut moderately close (Fig. 6), the fascia should be closed in by plain catgut, to avoid a pocket in the tissues that otherwise may result, and the skin may then be closed by buried sutures of plain catgut. I have usually covered the wound by collodion and a compress of sterilized gauze held in place by a figure-of-eight bandage.

In ten days the dressings are changed and a bandage for temporary support is applied. If healing has been complete,

the patient is allowed to sit up on the tenth day and leave the house on the fourteenth day after the operation.

The bandage used after the first dressing consists of a pelvic belt, of three thicknesses of canton flannel, with a compress of gauze over the former site of the hernia, and a perineal strap to prevent its slipping up. This is to be worn for four weeks. No truss or other permanent support should be worn.

As it is not an uncommon occurrence to have both inguinal and femoral hernia on the same side, it is deemed best to say a few words regarding the combined operations.

A single incision will answer every purpose, but it should be a little longer, beginning over the centre of the inguinal canal and curving downward, passing to the inner side and parallel with the femoral vessels to the saphenous opening. This incision gives easy access to both canals. The femoral sac should be removed and the canal closed in the manner already described, after which the inguinal hernia should be operated upon the same as though no complication existed.

*Suture.*—The idea that the suture in the operation described would make too much pressure on the femoral vein is a very natural one, but it is believed that with ordinary care this will never occur. At least in the cases presented no indication of undue pressure has ever been observed.

There has been no change in the technique of this operation during the fifteen years of its use by me, except in the suture material.

In the first twenty-two operations, No. 10 braided silk was used for closing the femoral opening. In three, silkworm gut was employed; but in the last eighty-five cases, *i.e.*, since November 20, 1896, kangaroo tendon has been used exclusively. There can be no question at the present day, it would seem to me, that the last-named substance approaches more nearly than any other the ideal suture for this purpose.

The deep sutures have been placed by a blunt needle with handle (Fig. 4). It is believed that the use of a sharp needle, or even a blunt needle in a holder, is attended by considerable danger of injury to the femoral vein.

# PUNCTURED WOUNDS OF THE BLADDER.

## REPORT OF A CASE, WITH A REVIEW OF THE LITERATURE.

**BY EDWARD EVANS, M.D.,**

OF LA CROSSE, WISCONSIN,

Surgeon to St. Francis's Hospital, La Crosse, Wisconsin,

AND

**HARRY ATWOOD FOWLER, M.D.,**

OF WASHINGTON, D. C.

WOUNDS of the urinary bladder are extremely uncommon. They are among the rarest surgical affections of that organ and are seldom observed in civil practice, except when produced by a surgeon's instrument. As Vidal said, "Il y a plus des plaies de la vessie faites par le chirurgien que des plaies dues à des accidents." The relative infrequency of wounds of the bladder is well shown by the following figures: Among 10,867 surgical patients treated at Bethany Hospital in eight years there were only three cases of bladder injury; there were only two such cases in 16,711 surgical patients admitted to St. Bartholomew's Hospital between 1869–75 (quoted from Bartels). In the 408,072 cases recorded in the War of the Rebellion, not a single case of punctured, incised, or lacerated wound of the bladder was reported, and there were only 183 cases of bullet wounds. These statistics serve to emphasize two points: (1) Wounds of the bladder are extremely uncommon. (2) They occur most frequently in the experience of military surgeons.

The following case from the service of Dr. Evans, of La Crosse, and reported before the Wisconsin State Medical Society in June, 1904, is of unusual interest, and forms the basis of this communication. On account of the relative infrequency of such accidents it has seemed to us that a brief summary

of the literature in connection with this case might not be without interest.

The history of the case is as follows:

J. B., aged eighteen years, while painting in St. Francis's Hospital, May 4, 1897, fell from a scaffolding, a distance of several feet, striking on the end of a slat eighteen inches long, two inches wide, and one-half inch thick, with two nails one and a quarter inches long driven transversely through the end (Fig. 1).

This slat entered the perineum just in front and to the left of the anus, tearing the sphincter ani muscle, the anterior wall of the rectum, and entered the bladder, producing a transverse wound of the trigone, two inches in extent, and separating the urethral from the ureteral openings. The point of the slat perforated the fundus of the bladder and entered the peritoneal cavity. The patient himself withdrew the stick, and in doing so drew out with it a piece of the omentum, which protruded from the wound about eight inches (Fig. 2).

The external perineal wound measured about two inches in length.

When found, the patient was considerably shocked. He was taken to the operating room, and immediate laparotomy was performed. Considerable urine, mixed with blood, was found in the peritoneal cavity, which was washed out with large quantities of normal salt solution. The rent in the fundus of the bladder, about one and a half inches long, was closed by three tiers of sutures,—the first two of catgut, the last of silk. The peritoneal cavity was again washed out and the abdominal wound closed without drainage.

Through the large perineal wound a drainage-tube was placed in the bladder, and the wound packed firmly with iodoform gauze. The patient returned to bed in good condition. The abdominal wound healed promptly. The patient suffered from severe iodoform poisoning, the symptoms coming on thirty hours after the operation, and rapidly subsiding after replacing the iodoform with plain gauze packing.

At a second operation, fourteen days later, the laceration of the bladder, rectum, and perineum was repaired. An examination of the perineal wound by means of retractors, separating the edges

FIG. 1.—Photograph of slat which perforated perineum, rectum, and bladder, entering finally peritoneal cavity.

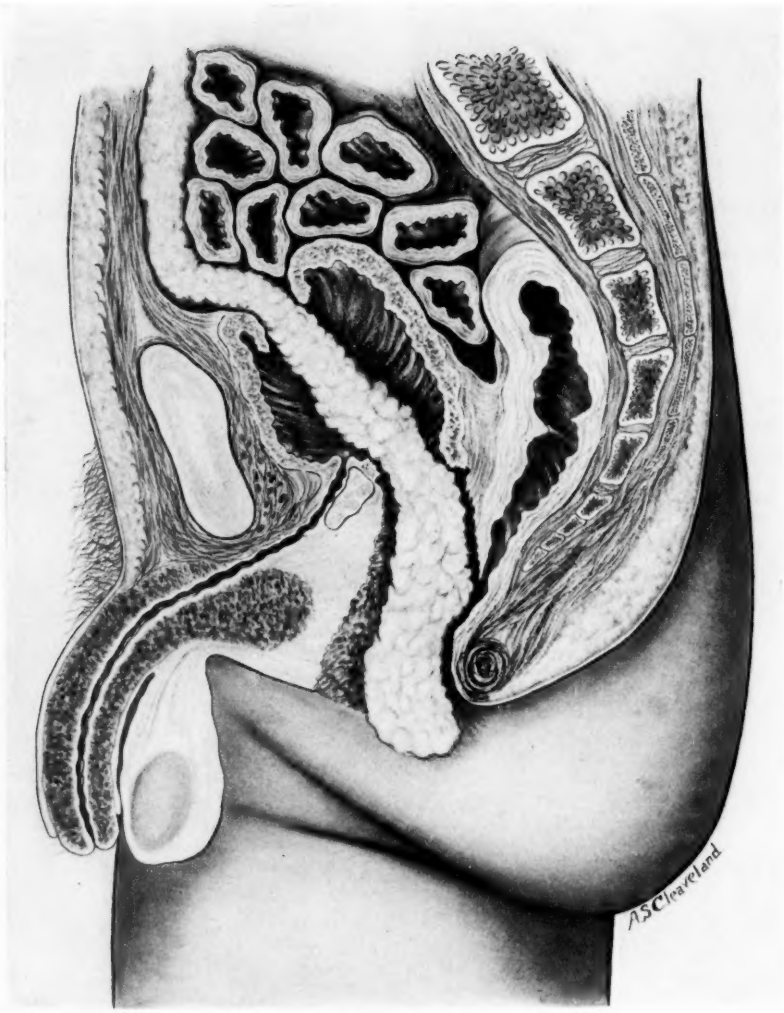



FIG. 2.—Longitudinal section of pelvis showing track of wound, with mass of omentum occupying it and protruding through perineal wound.

FIG. 3.—Wound in perineum dilated, exposing wounds in bladder and rectum.

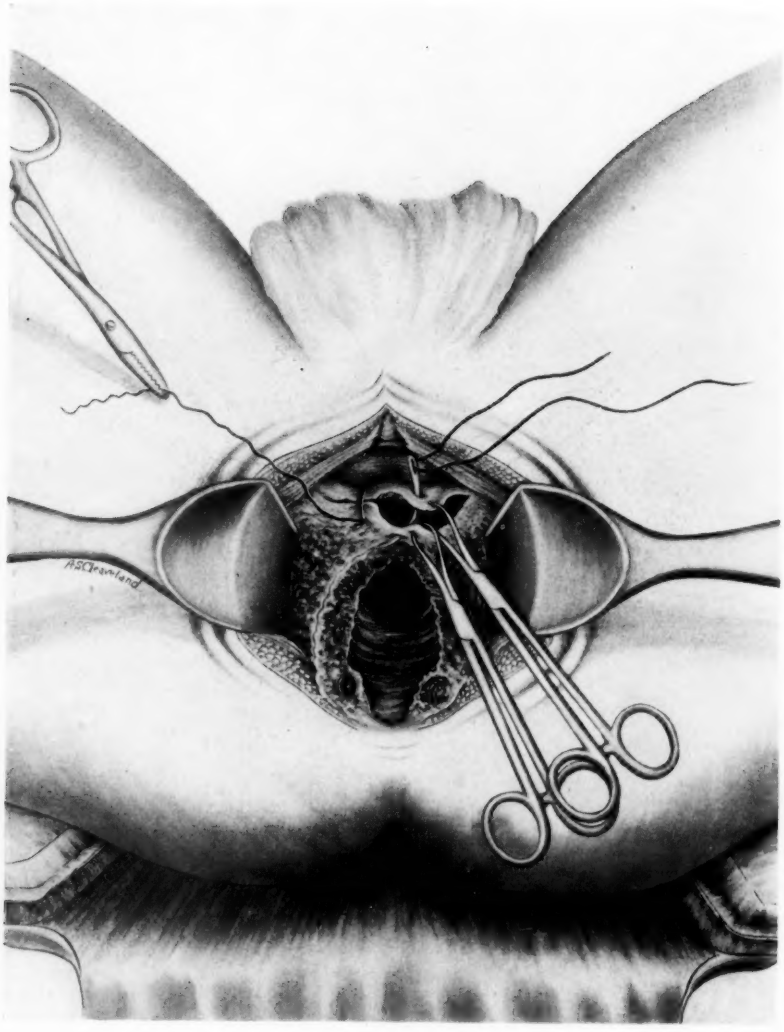


FIG. 4.—Repair of bladder wound.

FIG. 5.—Repair of rectal wound.

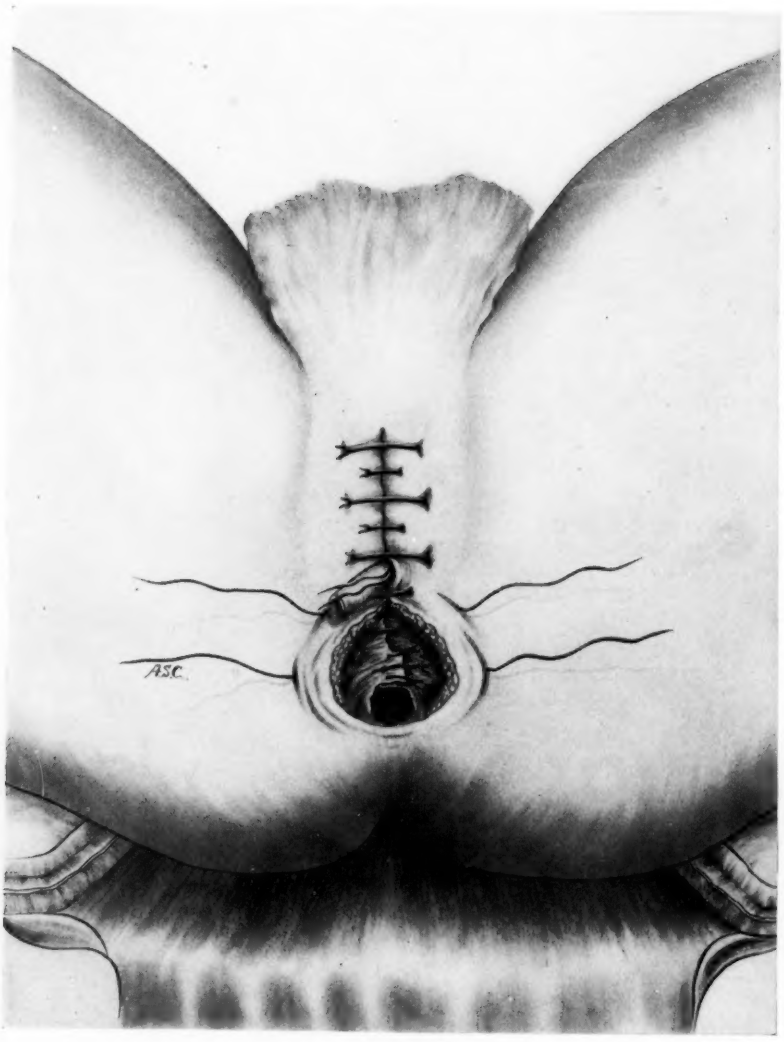



FIG. 6.—Final layer of superficial sutures closing perineal wound.

widely, showed that that portion of the trigone where the ureters enter the bladder was converted into a convex surface, on which the ureters could be plainly seen discharging their contents (Fig. 3).

The posterior edge of the wound was grasped with bullet forceps and drawn forward to the anterior edge, which was just behind the prostate, and held in position by the prostate fascia. The margins of the wound thus approximated were held in position by two silk sutures on either side of the middle line (Fig. 4). These sutures were tied, and the ends left long and brought out beside a drainage inserted into the bladder in the middle line.

The laceration of the rectum was next closed by a layer of catgut sutures tied on the mucous membrane (Fig. 5). The separated ends of the sphincter ani muscle were approximated and secured in position by silkworm-gut sutures. The superficial perineal wound was then closed as tightly as possible about the drainage-tube by catgut sutures (Fig. 6).

Recovery from the second operation was satisfactory. A vesicorectal fistula persisted for two months, which gave rise to some annoyance, but at the end of this time it was completely closed. Four months after this operation the bladder held six ounces, and the patient had to rise only once at night. One month later examination showed that the urine was normal and the patient was free from any rectal or vesical symptoms. Two years afterwards he reported that he was well and was without any functional disturbance whatever. Recently, the patient reports that his sexual and urinary functions are normal.

*Remarks.*—The above case presents several interesting features:

1. The circumstances surrounding the injury were most fortunate, allowing immediate laparotomy and suture of the intraperitoneal wound of the bladder.

2. The wound of the perineum, rectum, and trigone was so extensive as to necessitate surgical interference for the restoration of function. It may be noted here that this is the only case on record, so far as we have been able to discover, requiring an operation for the repair and closure of a perineal wound of the bladder.

3. The restoration of function was complete despite the severe injury to the trigone and, one would think, to the seminal vesicles and ducts.

Wounds of the bladder may be divided for convenience into (1) those presenting an external wound, and (2) those showing no external wound. The first may be subdivided into (1) puncture wounds produced by either (*a*) sharp instruments or (*b*) blunt instruments, and (2) bullet wounds; the second class includes cases of rupture. The bladder in its normal position is well shielded by the pelvic bones. These form a sufficient protection from injury by sharp or blunt-pointed instruments, except in unusual and infrequent accidents, as is shown by the experiences in the Civil War, where no injuries of this kind were reported. The bony pelvis, however, offers an insufficient barrier to penetrating wounds produced by bullets. Hence, as we would expect, the number of cases belonging to this class is very much greater, and they occur chiefly in times of war.

When the bladder has become overdistended, as the result of obstruction to the escape of urine, due either to a stricture of the urethra or, more commonly, to pathologic changes of the prostate, its walls may become stretched and much thinner than normal. Under these conditions, rupture of the bladder is not infrequent. Numerous cases of this kind are reported in the current literature. From these reports we learn that this accident often follows the most trivial injuries, such as slight falls, without any evidence whatever of external injury. The bladder, distended with foul urine, with its walls thinned by chronic overdistention, and often rendered less resistant by inflammatory changes, ulceration, etc., gives way with a slight sudden increase of pressure. The changes in the urinary tract producing conditions favorable to rupture of the bladder are not uncommon, and therefore rupture of the bladder is not a rare accident. It usually occurs in a bladder the seat of disease, the contents of which are generally infected; puncture wounds and bullet wounds, on the other hand, usually involve a normal bladder, the contents of which are sterile. This

broad distinction between the two classes of cases has much to do in explaining the relative mortality in these cases.

*Historical.*—Wounds of the bladder were described in the earliest times. Thus, Homer, in the Iliad, refers twice to this accident as rapidly fatal. The well-known aphorism of Hippocrates, "Cui persecta vesica lethale," has been often quoted to show that wounds of the bladder were considered by the ancients to be invariably fatal, and, so far as statistics of injuries of the bladder following accidents go, this was true. It has been alleged that there were many cases of recovery from wounds of the bladder known among the early writers, but so great was the reverence for the writings of Hippocrates, that these early observers doubted the correctness of their diagnosis, and were unwilling to record observations not in accord with the teachings of Hippocrates. It is more likely that a distinction was made at an early period between traumatic injuries of the bladder and those purposely made by the surgeon, and that even the former were not regarded as invariably fatal. Aristotle distinctly states that injuries near the neck of the bladder heal, and Galen records a case of recovery from wound of the bladder, and in commenting on the aphorism of Hippocrates contended that the idea conveyed by the language used was not that these wounds were absolutely fatal, but very dangerous.

Since injuries of this kind occur most frequently in military practice, it is quite natural that the first systematic account of them should be written by a military surgeon, D. J. Larrey, published in 1817. The elaborate and extensive memoir of Larrey records his careful and accurate observations made during his extensive experience in the Napoleonic wars. It is the first attempt at a complete and systematic study of the subject, and forms the basis for the further observations by later writers.

The next most important contribution was that of Stephen Smith, "A Contribution to the Statistics of Rupture of the Bladder, with a Table of Seventy-eight Cases," published in the *New York Journal of Medicine*, 1851. This was followed

by the reports of two Frenchmen, Demarquay, in 1851, and Houël, in 1857. In 1876 appeared the report of George A. Otis, in vol. ii, part 2, of the "Medical and Surgical History of the War of the Rebellion," containing an exhaustive summary of the records of the Civil War.

In this important work Otis analyzes and summarizes the experiences of the Civil War, and gives in the text and the footnotes numerous critical references to the early literature, which exhibits an extensive acquaintance with the whole subject. He points out that Larrey was the first to call attention to the fact that, while all accidental injuries of the bladder are very serious, those produced by shot are less dangerous than the others, and suggested that this was likely due to the nature of the wound, which was less favorable to urinary infiltration into the surrounding tissues. This same observer pointed out that the danger of bladder wounds depended in a measure on the contents of the bladder as to the degree of plenitude or vacuity at the time of the accident.

In a very important article under the title "Die Traumen der Harnblase," published in 1878, Max Bartels collected from the literature all the cases of wounds of the bladder which had been reported from the earliest times up to the date of publication of his article. These cases are divided into three groups,—puncture wounds, bullet wounds, and ruptures. A short abstract of each case is given. The statistics of each group are analyzed separately, while a general summary is presented in tabular form.

Bartels was the first and the only writer so far to collect all the reported cases scattered through the literature, for the purpose of comparison and analysis. The statistics furnished by this study are most valuable, and have been extensively quoted since by every writer on this subject.

The statistics included in this critical study may be taken to represent the results in this class of cases before the advent of modern surgery. In the great majority of cases the most that was done was to drain the bladder by a permanent catheter and cleanse the superficial wound. Operation was rarely

resorted to, and then only as symptoms developed demanding surgical interference, such as extravasation, abscess formation, etc. Just previous to the publication of Bartels's review, considerable interest in the question of operative interference in cases of wounds of the bladder was aroused by the report from America of a case of intraperitoneal rupture of the bladder successfully treated by laparotomy. This was the only case in Bartels's list of wounds of the bladder involving the peritoneum terminating in recovery, the one exception in a total of ninety-four collected cases.

Since the publication of Bartels's critical review, quite a number of cases of puncture wounds of the bladder have been recorded in the various journals, some of which are not easily accessible. These cases occurring since 1878 are particularly interesting as showing what advances surgery has made in the past three decades, and how these cases, which were formerly considered inevitably fatal, may now be saved by prompt interference.

In the English text-books of surgery very little space is given to this subject. It has therefore been considered of some practical interest and importance to give the results of the analysis of these scattered reports, which we have collected in connection with the case reported above. While we do not believe that our search of literature has been exhaustive, yet our list probably contains nearly all the cases on record since 1878, and, taken together with the list published by Bartels, forms a fairly complete record of the published cases.

In the following list the cases are arranged chronologically with reference to the date of the publication of the report, except in the last two cases. Following the name of the reporter, a short abstract of each case is given to indicate the sex and age of the patient, the nature of the instrument inflicting the wound, the point of entrance, the nature of the wound in the bladder, the treatment employed, and the result.

1. BEACH.—Boy, aged sixteen years, sitting on a window sash containing no glass. The sash gave away, and the boy fell on one of the upright pieces of the frame. Entrance through anus and rectum into the

bladder above the prostate gland. The patient pulled the piece of wood out, which was followed by copious hæmorrhage. Bladder wound admitted two fingers separated one-half inch. Treatment: retention catheter, rectal tube in bowel. Irrigation with thymol solution. Recovery in twenty-seven days.

2. BEACH (Bucé's case).—Man, aged forty-six years, pushed from load of fagots and fell on a stake driven into the earth. Entrance through anus and rectum into bladder immediately behind prostate gland. Intense pelvic pain. Treatment: patient was bled and full doses of opium given. Recovery in two months.

3. *Boston Medical and Surgical Journal*, 1879.—Farmer, aged thirty-two years, while descending from hay-mow fell on a sharp cart stake fourteen inches long and two inches in diameter at base. Entrance posterior to anus, into bowel, through anterior wall of rectum into bladder just behind the prostate. Bloody urine was withdrawn with catheter. Treatment: rest and cleansing of wound, catheterized every three hours. Temperature never rose above 102° F. Recovery complete in six weeks.

4. TREVES.—Seaman, aged twenty-three years, stabbed with knife. He walked into the dispensary, but was in a condition approaching collapse from loss of blood. Entrance wound one inch long, clean cut, situated exactly in middle of left buttock. No complaint at first. Two days later symptoms of peritonitis appeared, and on fifth day after injury the patient died. Autopsy showed that the knife had taken the following course: through the gluteal muscles, divided part of great sacrosciatic ligament, passed through small sciatic notch, completely dividing the pudic artery and nerve and one vein, then entered the bladder at its lower part close to the trigone, making a wound large enough to admit tip of the fore-finger.

5. STOKES.—Boy, aged sixteen years, laborer in foundry, in play was vaulting over a pair of long forger's tongs. Failed to clear the tongs and came down on the long handle, which passed into anus; symptoms of peritonitis developed immediately, and patient died seventy-four hours after injury. Autopsy: general peritonitis, subdiaphragmatic collection of pus. Double perforation of bladder; fundus perforated a little to left of median line.

6. JACKSON.—Carman, aged twenty-four years, while loading a truck slipped and fell on a "trolley," such as railway porters carry. This tore his trousers and entered the rectum. Great suprapubic pain and pain in rectum; sphincter ani paralyzed and dilated; bowel contained blood. Six ounces bloody fluid withdrawn by catheter. Rent in bladder one inch above prostate. Recovery in one month.

7. GALLER.—Young man, aged twenty-four years, stab-wound 2 centimetres long over left inguinal canal, cutting half-way through the vas deferens. Blood and urine escaped from wound. Symptoms of peritonitis developed. Retention of catheter for six days. Recovery in forty-four days. (Writer states peritoneum was opened, but there is no evi-

dence of injury of peritoneum except symptoms of transient peritonitis, so we class this as extraperitoneal.)

8. PANIZO.—Man; incised wound in hypogastric region one to two fingers above symphysis; wound 9 centimetres long, extending obliquely upward and outward. Bloody fluid from wound. Catheter in bladder felt through the wound. Wound in bladder and peritoneum each 6 centimetres long. These closed at operation by catgut interrupted sutures. Large abscess formed in wound after operation extending up to xiphoid cartilage; two litres of pus evacuated on the sixth day, followed by multiple ulcers over sacrum and trochanters; abscess reformed above symphysis. Final recovery in three months.

9. LIVON.—Man, aged forty years, house painter, stabbed with knife in hypogastrium little to left of middle line 3 centimetres above symphysis. Catheter withdrew 500 cubic centimetres bloody urine. Following injury, urine all came through wound. No symptoms of peritonitis. Retention of catheter nineteen days. Recovery in eleven weeks.

10. FIORANI.—Man, aged thirty-three years, stabbed with a knife. Entrance, right genitocrural fold. Tenesmus immediately following injury, passed small amount of bloody urine. Pains in abdomen, fulness in pelvis and dulness in hypogastric region with pain on pressure. Cystotomy performed ten hours after injury, rubber drainage-tube in incision, no suture. Drainage-tube removed in one month. Four months after injury patient left hospital, but the dulness in hypogastrium persisted. Some time later he returned to hospital, and an abscess was opened in hypogastric region. Forty grammes of pus evacuated. Eventual complete recovery.

11. HENSGEN.—Boy, aged seventeen years, on a spree, very drunk, stuck a three-cornered file into his back, which penetrated the sacrum about 10 centimetres above the anus, passing through the rectum into the bladder. After the injury the patient rode thirty-five minutes on a train and walked fifty minutes to his home with the file still sticking in his back. The wound in the bladder was in the upper part of the posterior wall. Symptoms of peritonitis present for a short time. Bloody urine. When he sat up in bed no urine escaped from the wound, but on lying down the urine was passed from this opening, and was increased by coughing, etc. Eventual recovery without operation. (Writer believes the peritoneum was injured, but the details of the case, considered in connection with other similar cases, leads us to classify this case as one of extraperitoneal wound of the bladder.)

12. BACCHI.—Countrywoman, aged twenty-two years, fell several metres, striking on her side on a corrugated step. Piece of sharp wood entered right groin, passing upward and inward. Copious hæmorrhage. Sent to hospital two days after injury. Wound 5 centimetres long, extending vertically beneath the labia into the pelvis, emitted fetid odor, and cavity contained clots of blood and ragged tissue. Tumor in pelvis soft and pasty. Catheter in bladder withdrew fluid injected into the wound. Suprapubic cystotomy. Peritoneum stripped back, exposing two vertical fissures in inferior posterior portion of bladder below the ureters; one 3 centimetres, the other 1 centimetre long. Interrupted suture of both wounds.

Drainage through wound in groin. Permanent catheter. Bladder sutures held, but there was infection of the wound carried in by the foreign body. Recovery in six weeks.

13. SOULIÉ.—Young man, aged twenty years. Knife thrust in left buttock. Wound 3 centimetres long, situated behind the superior part of the ischium at the level of the small sciatic notch. He passed some bloody urine directly after injury. Irrigations into bladder noted to pass out through the wound. Treatment: suprapubic cystotomy, bladder opened, and formal diagnosis of wound of bladder made; abdominal drainage. Recovery. Suture of bladder (?).

14. HAMILTON.—Boy, aged sixteen years, fell backward in a sitting posture, striking on a newly-cut corn stub, which entered the anus and penetrated the rectum a distance of three inches. Passed bloody urine immediately after injury. Examination: incised wound right side of anus beginning one and one-half inches external to anal margin and extending upward to a point beyond the inner boundary of the sphincter. Gas and fæces escaped involuntarily. Edges of wound could be separated one-half inch. Treatment: edges of wound brought together and sutured. Suppuration of wound occurred, urine and blood were passed through wound. Retention catheter and sedatives. Urine through the wound gradually diminished. Complete recovery in three weeks.

15. ORDRIOZOLA.—Journalist, aged thirty-four years, fell on a piece of "cut cane," which entered anus. Fainted from pain. There was bleeding from the wound. Admitted to hospital two days later. Stools contained blood and urine. He assumed right lateral decubitus with legs flexed on abdomen, and presented abdominal facies; temperature, 39° C. Rectal examination: rounded wound in upper part of left lateral wall of rectal ampulla. Sphincter not lacerated, no external wound. Abdomen was tympanitic, vomiting, pulse small. Urine passed per rectum. Patient catheterized for first time on fifth day after injury, removing fetid bloody urine and blood-clots. There was a free communication between bladder and rectum. Recovery without operation in two months. (Report very fragmentary and incomplete.)

16. DELAGENIERE.—Man, aged thirty-four years, empaled on a picket, which entered perineum and perforated the bladder through and through. Entrance wound in left side of perineum 4 centimetres long, beginning behind, near the ischium, and extending forward towards the root of the scrotum. Bloody urine withdrawn with soft catheter. No symptoms of peritonitis being present on admission ten hours after injury, operation was deferred till the following morning, when peritonitis was marked. Laparotomy: intestines reddened, dark fluid—blood and urine—in peritoneal cavity. Bladder distended with clots. On posterior surface of bladder was a transverse wound 2 centimetres long. This was closed with row of catgut, copious lavage of peritoneal cavity, large quantity of sterile water left in cavity. Drain in pelvis. This was followed by suprapubic cystotomy. Clots removed, wound in trigone discovered, admitting tips of two fingers. Wound packed and incision left opened. Recovery in two months.

17. ALSBERG.—Boy, aged nine years, fell on an iron picket fence. Entrance: inner side of thigh, 10 centimetres below inguinal fold. Pierced the symphysis and produced double perforation of the bladder. Laparotomy about eighteen hours after injury, suture of wound, removal of clots of blood and fibrin. Drainage of operation wound with rubber tube. Complete recovery.

18. DODD.—Workman in royal gun factory pulling on a rope with another man; rope broke; patient fell backward with the other man on top of him, striking on a bar of iron seven-eighths inch in diameter and several feet in length, the end being bent at right angles and sticking up several inches from the floor. Entrance wound: buttock, entered the rectum two inches above the sphincter, perforated the anterior wall of the rectum, and entered the urethra through the substance of the prostate gland. Treatment: wound in buttock opened into the rectum as in operating for a fistula. Pieces of cloth removed from the depths of the wound. Permanent catheter. Bladder irrigations. Uninterrupted recovery.

19. GROSS.—Man, aged twenty-four years, fell from height of three metres and was empaled on a stick. Entered perineum, passing through the bladder into the peritoneal cavity without entering the rectum. On admission to hospital, a few hours after injury, there were no symptoms pointing to a deep wound. On the following morning peritonitis was marked. No blood or urine escaped from the wound, but a catheter withdrew 150 grammes of almost pure blood. Median laparotomy performed. Peritoneal cavity contained about two litres of urine. A wound 5 to 6 centimetres obliquely transverse near tip of fundus was closed, and a minute toilette of the peritoneal cavity performed, drainage, retention catheter; drainage of perineal wound. Patient died the following morning. Autopsy: spreading peritonitis particularly marked on right side. In right flank were found two foreign bodies overlooked at the operation, made up of pieces of skin, undershirt, and trousers.

20. WEISCHER.—Two men while mowing quarrelled, one striking the other with his scythe, inflicting a wound in the gluteal region. Scythe was removed with difficulty. Removal followed by escape of blood mixed with urine. Wound 7 centimetres long between left posterior inferior spine of ilium and the trochanter, passed inward through the foramen ischiadicum magus and penetrated the bladder. No symptoms of peritonitis. Treatment: drainage of wound with rubber tube and irrigation of the bladder. Recovery.

21. TUFFNELL.—Man was riding on a load of hay with a pitchfork sticking in the hay near him. The load was overturned, throwing the man to the ground. When picked up, he was bleeding from the bowel. No external injury. Catheter withdrew no urine. Following morning urine passed per rectum. Died in five days. Autopsy: pitchfork tine had split substance of prostate into two equal parts and penetrated the tissues behind the pubis. Intestines were matted, exhibiting the usual signs of acute peritonitis, but there was no opening into the peritoneal cavity to be found.

22. BIRKET.—Man injured by falling on a sharp stake driven into the ground, which entered the anus and pierced the rectum and bladder. There was intense pain immediately following the accident. The wound of the bladder was extraperitoneal. Recovered. (I have been unable to find the original report of this case. The incomplete notes here given are from a reference to the case made by Stokes.)

23. JAWDYNSKI.—Man, aged thirty-six years, trader. During a quarrel a knife was plunged into his right buttock. On the operating table the wound was found to be 7 centimetres from the median line, 11 centimetres from the fold of the nates, and 3 centimetres in length. A finger in the wound passed through the ischiatic foramen into the pelvic cavity as far as the rectum. The wound was 12 centimetres deep. It was widened, the gluteal artery ligated, and the wound then closed except for a gauze drain. In the evening the patient complained of inability to urinate; a catheter withdrew bloody urine. The following day the dressings were found saturated with urine. A solution of potassium iodide instilled into the bladder passed through the wound. The wound was then tamponed up to the bladder and a retention catheter used. Complete recovery in three months.

24. ROSENBAUM.—Male, aged twenty-nine years, wounded in the abdomen by a dagger. The injury was followed by sharp abdominal pain, desire to urinate but inability to void, prolapse of omentum and bowel. The patient on examination soon after the accident was found in a condition of profound shock. The wound, 6 centimetres long, was situated two fingers above Poupart's ligament, extending upward and to the left and had penetrated the abdominal cavity. There was prolapse of a piece of the omentum the size of one-half a hand and loops of the small intestine. The prolapsed omentum was ligated and excised; the bowel, being uninjured, was returned to the abdominal cavity. A silver catheter withdrew a small amount of bloody urine. The bladder was next examined through the abdominal wound. An opening into the bladder admitting the tip of the index-finger was found. The abdominal wound was enlarged to 13 centimetres and the bladder drawn up out of the pelvis. In doing so, a large quantity of extravasated urine and blood was brought up with it. The wound in the bladder, 5 to 6 centimetres long, was closed with a row of Lembert's silk sutures. The abdominal wound was closed except for a drain at the lower angle. A retention catheter was used. Except for an abscess developing in the scrotum, recovery was uneventful, and the patient discharged well in nine weeks.

The bladder may be reached by penetrating instruments in three ways: (1) through the suprapubic region, (2) the obturator foramen, and (3) the perineum. At these three points the bladder is directly exposed to injury, being unprotected by the bony pelvis. It might be supposed that, being

entirely unprotected from above, the bladder would be frequently lacerated in stab-wounds of the abdomen; that in times of war, bayonet, lance, and sabre wounds would be frequent. In the fierce hand-to-hand fighting, when bayonet charges are resorted to, it seems almost impossible that the bladder should escape. But it is a noteworthy fact that not a single case of bayonet wound of the bladder has been recorded. Indeed, stab-wounds of the bladder through the suprapubic region are not as common as we would expect. It is a curious fact that the bladder is relatively and absolutely more frequently injured by puncture wounds through the perineum. Arranged in order of frequency, we have (1) perineum, (2) hypogastrium (suprapubic), (3) obturator foramen. In the list above, there are several cases in which the entrance wound was not in either of the three regions enumerated, although they might be properly classified as subdivisions. They have, however, been separately classified as follows:

(1) Gluteal region. Five cases,—four by sharp instruments and one by a blunt instrument. Of the sharp instruments, one was a scythe and three were knives. The blunt instrument was a bar of iron (No. 18 in the list).

(2) Sacral. One case, No. 11. This is a unique case as to the location of the wound and the nature of the instrument producing it. This patient was carrying a three-cornered file in his pocket. During a drunken spree, it is supposed that he fell, wounding himself with the file in several places. Finally, he was unfortunate enough to fall in such a way as to run the file through his sacrum 10 centimetres above the anus. With the file still sticking in his back, he rode on the train for thirty-five minutes, then walked for fifty minutes more to his home. A physician was summoned, who, without apparently making a very thorough examination, left a prescription. Sometime after this visit the file was removed from the wound by a friend.

(3) Thigh. One case, No. 17. This is the only case recorded in which the protecting bony framework of the pelvis has been bored through by the penetrating instrument, and

the bladder injured. The accident resulted from a fall; the patient was empaled on an iron picket, which, after piercing the symphysis, passed completely through the bladder into the peritoneal cavity.

(4) Groin. Three cases. In two the wound was produced by a knife; in the third by a sharp stake. This latter case, the only female in the list, is interesting, as there was produced a double wound in the bladder without an involvement of the peritoneum. The stake, entering the right groin, passed obliquely upward beneath the labia, piercing the bladder in two places, making two vertical wounds, and lodged in the cellular tissue of the left pelvic space.

The entrance wounds produced by sharp instruments were thus distributed: perineum, 1; gluteal region, 4; suprapubic, 3; groin, 2. In every instance but one the injury was the result of a quarrel. In marked contrast are the wounds produced by blunt instruments. They were thus distributed: perineal, 11; gluteal, 1; sacral, 1; groin, 1; thigh, 1. It is a curious fact that such a large majority of these wounds occurred in the perineum, and in every case was the result of a fall from a greater or less height; in every case save one the rectum was also perforated. In this last case (No. 19), double perforation of the bladder was produced by a fall from a height of 3 metres, the patient being empaled on a stick, which entered the perineum and passed through the bladder without wounding the rectum.

*Variety of Instruments.*—Among the list of sharp instruments, the wound was made by a knife in seven cases, by a scythe in one case, by a pitchfork tine in one case, and in one case by a dagger. There is a greater variety of blunt instruments. The list includes the following: A piece of wood (stake), six cases. One case each of portion of window sash, handle of forger's tongs, "trolley," three-cornered file, stub of corn-stalk, bar of iron and lathe, and two cases of iron picket. Double perforation was produced in the last two cases.

These cases are tabulated as follows:

TABLE 1.

PUNCTURE WOUNDS OF THE BLADDER; LOCATION OF ENTRANCE WOUND; INSTRUMENTS.

| Instruments. | Perineo-anal. | | Gluteal. | | Abdominal. | | Sacral. | | Groin. | | Thigh. | | Total. | | Died. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sharp | 1 | .. | 4 | .. | 3 | .. | .. | .. | 2 | .. | .. | .. | 10 | .. | .. |
| Knife | .. | .. | .. | 3 | .. | 2 | .. | .. | .. | 2 | .. | .. | .. | 7 | 1 |
| Scythe | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Pitchfork tine | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Dagger | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Blunt | 11 | .. | 1 | .. | .. | .. | 1 | .. | 1 | .. | 1 | .. | 15 | .. | .. |
| Stake | .. | 5 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 6 | 1 |
| Lathe | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Window-sash | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Handle of forger's tongs | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | 1 |
| Porter's "trolley" | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Three-cornered file | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 | .. |
| Corn-stalk stub | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Iron picket | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 2 | .. |
| Bar of iron | .. | .. | .. | 1 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 1 | .. |
| Total | 12 | 12 | 5 | 5 | 3 | 3 | 1 | 1 | 3 | 3 | 1 | 1 | 25 | 25 | 4 |

*Nature of the Wounds.*—Of the 25 cases, 7 were intraperitoneal and 18 extraperitoneal.

*Intraperitoneal.*—There were 7 cases with 2 deaths, or a mortality of 28.5 per cent. In 6 cases laparotomy with closure of the bladder wound was performed at varying intervals after the accident. Of these 6 cases, 5 recovered and 1 died, a mortality of 16.6 per cent. The cause of death in this fatal case was a violent peritonitis resulting from overlooking at the operation two foreign bodies in the peritoneal cavity composed of pieces of skin, undershirt, and trousers, which had been carried in by the penetrating instrument (Case 19). One case not operated upon terminated fatally seventy-four hours after injury. Barring the oversight in the case referred to, the mortality in cases operated upon should be *nil*, while the mortality in cases of intraperitoneal wounds of the bladder not operated upon was 100 per cent. This agrees with Bartels's statistics. In ninety-four cases of wounds of the bladder from all causes involving the peritoneum, ninety-three ended fatally,—the one case of recovery was the only case operated upon. In the ten cases of puncture wounds of the bladder in which the peritoneum was injured the mortality was 100 per cent. It may be remarked here that a comparison of the

statistics of these two groups of cases emphasizes the value of operative interference in these cases, and illustrates what surgery has accomplished in this class of injuries.

*Extraperitoneal.*—Among the cases classified as extraperitoneal are several with symptoms of peritonitis, and for this reason they were reported as cases of intraperitoneal wounds. But in every case the peritonitis was localized and transient, and it seems improbable that the peritoneum was injured in any of these cases. We know, furthermore, from autopsy findings, that symptoms of peritonitis may be marked in certain cases of wound of the bladder, without, however, showing any injury of the peritoneum.

Of the 18 cases, 2 died, a mortality of 11.1 per cent. Neither of these 2 cases was operated upon. Two of the 18 cases were operated upon, and both recovered. The cause of death in the two fatal cases was extravasation of urine with diffuse suppuration (Nos. 4 and 21). In the last case (No. 21), symptoms of peritonitis were marked, although at autopsy it was found that the peritoneum had not been injured.

TABLE II.

GENERAL SUMMARY.

| | | | Intraperitoneal. | | | | | Extraperitoneal. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No | Died. | Mortality. | No. | Died. | Mortality. | Operated on. | Mortality. | No. | Died. | Mortality. | Operated on. | Mortality |
| 25 | 4 | 16 per cent. | 7 | 2 | 28.5 per cent. | 6 | 16.6 per cent. | 18 | 2 | 11.1 per cent. | 2 | 0 per cent. |

*Double Perforation of the Bladder with Injury of the Peritoneum.*—Of all injuries of the bladder, puncture wounds which perforate this viscus in two places and produce a laceration of the peritoneum are the most infrequent. This is an exceptionally rare accident. Only two cases are recorded in Bartels's list of fifty cases of puncture wounds. Four additional cases have been collected, and are included in the above

list of intraperitoneal wounds, while the case here reported makes seven cases in all.

The two cases collected by Bartels are as follows:

1. A soldier in a drunken quarrel was stabbed by a fellow soldier with a "Danish Hohlklinge," which entered the hypogastrium just above the symphysis and a little to the left of the middle line, passing through the peritoneal cavity, the ileum, and the bladder, passing out behind near the coccyx. The wounds were small. Prolapse of the injured bowel. Patient lived twenty-one days.

2. Man, aged forty-three years, fell on the leg of a chair. Entrance through the anus into the bladder. Great pain in the bladder region and pelvis. Collapse. Catheter withdrew bloody urine. Beginning peritonitis. Died in twenty-one hours. Autopsy: rectum and neck of bladder pierced; a second wound of the fundus communicated with the peritoneal cavity. Bloody fluid found in the latter.

The four cases reported in the literature since 1878 are abstracted in the list above, Nos. 5, 16, 17, and 19. In only one case was the wound made by a sharp instrument, No. 1 above, collected by Bartels. The accident resulted from a quarrel.

In six cases the injury resulted from a fall on a blunt instrument, as follows: chair leg, 1; iron picket, 2; handle of forger's tongs, 1; lathe, 1, and stick, 1. In five of these cases the entrance wound was in the perineum. In the sixth case an iron picket entered the inner side of the thigh 10 centimetres below the inguinal fold. In all but one case in which the point of entrance was in the perineum the rectum was perforated and a vesicorectal fistula persisted for a considerable time. In no case was the fistula permanent, and in no case was a separate operation for its closure necessary.

Of these seven cases of double perforation, three were fatal,—one in twenty-one days, one in twenty-one hours, and the third in about thirty hours, a mortality of 42.8 per cent. It is to be noted, however, that the 42.8 per cent. represents the total mortality, including the cases which were operated upon and those which were not. If we analyze the cases farther, we find that in three cases no operation was performed, and all ended fatally, giving a mortality of 100 per cent. In the four

cases subjected to laparotomy and suture of the bladder wound and peritoneum three cases were saved, thus giving a mortality of 25 per cent. This fatal case died from peritonitis resulting from a foreign body introduced into the peritoneal cavity at the time of the accident and overlooked at the operation, as noted above. These statistics again strongly emphasize the value of immediate operation in intraperitoneal wounds of the bladder.

TABLE III.

CASES OF DOUBLE INTRAPERITONEAL PERFORATION OF THE BLADDER, SHOWING THE KIND OF INSTRUMENT, LOCATION OF ENTRANCE WOUND, OPERATION, AND RESULTS.

| Instruments. | Perineum. | Suprapubic. | Through Symphysis. | No. | Died. | Mortality. | No. operated on. | Died. | Mortality |
|---|---|---|---|---|---|---|---|---|---|
| Sharp | .. | .. | .. | 7 | 3 | 42.8 per cent. | 4 | 1 | 25 per cent. |
| "Danish Hohlklinge" | .. | 1 | .. | .. | .. | ..... | .. | .. | ..... |
| Blunt | .. | .. | .. | .. | .. | ..... | .. | .. | ..... |
| Chair leg | 1 | .. | .. | .. | .. | ..... | .. | .. | ..... |
| Iron picket | 1 | .. | 1 | .. | .. | ..... | .. | .. | ..... |
| Lathe | 1 | .. | .. | .. | .. | ..... | .. | .. | ..... |
| Handle of tongs | 1 | .. | .. | .. | .. | ..... | .. | .. | ..... |
| Stick | 1 | .. | .. | .. | .. | ..... | .. | .. | ..... |

A brief summary of Bartels's cases may be given for the sake of comparison, and, taken together with the above, gives fairly complete statistics for punctured and lacerated wounds of the bladder.

Bartels collected 504 cases of injury of the bladder, classified as follows: punctured wounds, 50 cases; bullet wounds, 285 cases, and rupture, 169 cases. Death resulted in 228 cases, or a mortality of 45 per cent. Of the 504 cases, 131 were intraperitoneal and 373 were extraperitoneal.

Every case of intraperitoneal wound terminated fatally except one, the case of rupture, reported by Walther, of Pittsburg, in which recovery followed laparotomy, cleansing of the peritoneal cavity, and the use of a retention catheter, without, however, suture of the wound in the bladder. The mortality was, therefore, 99.2 per cent. Of the 373 cases of extraperitoneal wounds, 85 terminated fatally, a mortality of 22 per

cent. If we analyze these cases farther, we find the per cent. of mortality varied greatly with the nature of the injury; thus for puncture wounds it was 2.5 per cent.; bullet wounds, 15 per cent.; and for ruptures, 61 per cent. These results are given in the following table, slightly modified, from Bartels.

TABLE IV.

INJURIES OF THE BLADDER.

| Injury | Total. | Death. | Mortality. | Intraperitoneal. | | | Extraperitoneal. | | | Rectum Injury. | Bone Injury. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Total. | Death. | Mortality. | Total. | Death. | Mortality. | | |
| Puncture... | 50 | 11 | 22 per cent. | 10 | 10 | 100 per cent. | 40 | 1 | 2.5 per cent. | 13 | ... |
| Bullet..... | 285 | 65 | 22.8 per cent. | 27 | 27 | 100 per cent. | 258 | 38 | 15 per cent. | 60 | 131 |
| Rupture.... | 169 | 152 | 90 per cent. | 94 | 93 | 99 per cent. | 75 | 46 | 61 per cent. | 1 | 65 |

Of the 50 cases of puncture wounds, 20 were produced by blunt and 26 by sharp instruments, while the remaining 4 were gored by animals,—3 by steers and 1 by a bison. In 22 cases the entrance wound was in the perineum; 5 were produced by sharp and 17 by blunt instruments. Of these 5 cases, 3 recovered, and 2 died from peritoneal injury.

In the 17 cases in which the injury was due to a blunt instrument, this entered the anus in 13 cases, and the rectum was perforated in every case. In 4 cases the wound entered the perineum, reaching the bladder without wounding the bowel. Three of the 13 cases ended fatally; in two of these there was definite involvement of the peritoneum, while in the third the symptoms strongly pointed to that complication.

These cases are tabulated by Bartels as follows:

The combined statistics then include 75 cases of puncture wounds of the bladder; 15 of these were fatal, a mortality of 20 per cent. The most striking feature of these two groups of cases is the great difference in the per cent. of mortality in the intraperitoneal wounds. In Bartels's series this is 100 per cent., while in the 25 cases which we have collected it is 28.5 per cent. This marked diminution in the per cent. of fatal

cases is explained by the fact that operative interference was more frequently resorted to, and a relatively large number of cases were saved.

TABLE V.

TABLE OF PUNCTURE WOUNDS OF THE BLADDER.—BARTELS.

| Instruments. | Regio Perineo-anal. | | Obturator foramen. | | Abdominal. | | Not stated. | | Healed. | | Died. | | Not stated. | | Summary. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A. Sharp-pointed weapons | 5 | .. | 1 | .. | 19 | .. | 2 | .. | 19 | .. | 8 | .. | .. | .. | 27 | .. |
| Lances | .. | .. | .. | 1 | .. | 1 | .. | .. | .. | 2 | .. | .. | .. | .. | .. | 2 |
| Daggers | .. | 2 | .. | .. | .. | 4 | .. | 2 | .. | 5 | .. | 4 | .. | .. | .. | 8 |
| Knives | .. | 1 | .. | .. | .. | 8 | .. | .. | .. | 8 | .. | 1 | .. | .. | .. | 9 |
| Pitchfork | .. | .. | .. | .. | .. | 1 | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 |
| Not stated | .. | 2 | .. | .. | .. | 5 | .. | .. | .. | 3 | .. | 3 | .. | .. | .. | 7 |
| B. Blunt-pointed | 17 | .. | .. | .. | 1 | .. | 2 | .. | 16 | .. | 3 | .. | 1 | .. | 20 | .. |
| Pitchfork handle | .. | 2 | .. | .. | .. | .. | .. | 1 | .. | 2 | .. | 1 | .. | .. | .. | 3 |
| Chair leg | .. | 2 | .. | .. | .. | 1 | .. | .. | .. | 2 | .. | 1 | .. | .. | .. | 3 |
| Stick—broom-handle | .. | 11 | .. | .. | .. | .. | .. | 1 | .. | 10 | .. | 1 | .. | 1 | .. | 12 |
| Hot iron | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 |
| Lead-pencil | .. | 1 | .. | .. | .. | .. | .. | .. | .. | 1 | .. | .. | .. | .. | .. | 1 |
| C. Animals' horns | .. | .. | .. | .. | .. | .. | 3 | .. | 3 | .. | .. | .. | .. | .. | 3 | .. |
| Steer | .. | .. | .. | .. | .. | .. | .. | 2 | .. | 2 | .. | .. | .. | .. | .. | 2 |
| Bison | .. | .. | .. | .. | .. | .. | .. | 1 | .. | 1 | .. | .. | .. | .. | .. | 1 |
| Total | 22 | 22 | 1 | 1 | 20 | 20 | 7 | 7 | 38 | 38 | 11 | 11 | 1 | 1 | 50 | 50 |

*Diagnosis.*—The diagnosis of injury of the bladder in penetrating wounds of the lower abdomen and perineum is rarely difficult. The escape from the wound of blood *mixed with urine* leaves no doubt that the bladder has been entered. In the majority of cases this sign has been present. The withdrawal of bloody urine by means of the catheter is an equally positive indication that the bladder has been injured. This examination should never be neglected whenever there is a question as to whether or not the bladder has been punctured, and it should be made early. In the case of a wound made by a small sharp instrument, it may be so small as to become effectually closed by a blood-clot, and thus prevent the escape of urine. We may not suspect its depth, unless we catheterize the patient and withdraw urine mixed with blood; and just this class of wounds are the most important, since we are more apt to overlook the gravity of the condition until the extravasa-

tion of urine into the peritoneal cavity or into the perivesical tissues warns us that what we considered so trivial is in fact a serious accident. Mistakes of this kind have happened, and the consequences in some cases have been serious.

After it has been definitely determined that the bladder has been wounded, there still remains the more important question of whether or not the peritoneal cavity has been opened. This is by no means so easily determined, and yet an early diagnosis is of the utmost importance, as the success or failure of an operation may depend upon the time which has elapsed since the receipt of the injury,—the longer this interval the smaller the chances of recovery. Too often in the cases reported this accident has been recognized only after the symptoms of peritonitis have become well defined, or, indeed, in some cases only at autopsy was the true nature of the injury discovered.

In those cases where, following an injury of the bladder, there is prolapse of the omentum, as in the case here reported, or of the bowel, as in one of the collected cases, there can be no doubt as to the peritoneal involvement and the necessity for prompt interference to save the patient's life. Such cases are, however, exceedingly rare. In the majority of cases where doubt exists a positive diagnosis can be made only by an exploratory incision and a careful inspection of that portion of the bladder covered by peritoneum; and such examination should not be delayed. We know that, in rupture of the healthy bladder and extravasation of its contents into the peritoneal cavity, the urine may lie in contact with the peritoneum for many hours without giving rise to symptoms of peritonitis. In puncture wounds involving the peritoneum, however, the danger of infection, carried in by the foreign body, is increased many fold. Symptoms of peritonitis, therefore, are likely to make their appearance much earlier, and are usually much more violent. Hence the necessity for an early diagnosis becomes imperative.

It might be thought *a priori* that the position of the entrance wound would be significant; that the peritoneum is

more likely to be injured when the instrument reaches the bladder through the hypogastrium. This is not borne out, however, by the statistics. Of the ten cases of intraperitoneal wounds in Bartels's list, in at least 50 per cent. the entrance wound was in the perineal and sacral regions, while in our list of seven cases there is only one case in which the entrance wound was in the hypogastrium.

Following a laceration of the bladder, if a catheter withdraws only a few cubic centimetres of bloody urine even with repeated catheterizations, and no considerable amount of urine is escaping from the wound, we may strongly suspect that the peritoneum has been wounded, and that extravasation is taking place into the abdominal cavity. Under such circumstances, exploratory laparotomy should be performed at once. In every case of wound of the bladder, when positive signs are absent enabling us to settle the question of peritoneal laceration, we are justified in following the dictum, " When in doubt, explore."

*Treatment.*—The treatment to be employed will depend naturally upon the nature of the wound, *i.e.*, whether it is extraperitoneal or intraperitoneal, or a combination of the two, as in certain cases of double perforation. In extraperitoneal wounds the chief danger to the patient is extravasation; and hence it is against this complication that whatever measures are taken should be directed. The seriousness of this accident is greatly intensified by the fact that the tissues along the track of the wound have been almost invariably infected, and hence rapid and extensive suppuration and destruction of tissue supervene. The essential point in the treatment of these cases is *free drainage.* When the wound is large and permits the free escape of urine from the bladder, there is little danger of this complication. Such a case will generally heal promptly with the usual cleansing and care of the wound and a retention catheter for a few days, or, where this is not well borne, regular emptying of the bladder every three hours by means of the catheter. In a few days the urine will begin to be

voided naturally in increasing amounts, while the escape of urine through the wound will gradually diminish, and finally cease altogether in a relatively short time, and the wound rapidly granulate. In no case has it been found necessary to close the opening in the bladder by operation.

If the track produced by the instrument be small and the escape of urine is insignificant, the wound should be opened up freely by incision, cleansed out thoroughly, and free drainage of the bladder established. Where the wound is so situated that it is impossible or inadvisable to enlarge it sufficiently to allow the free escape of urine, perineal section should be performed at once. This gives perfect drainage of the bladder, thus avoiding the possibility, and even almost certain probability, of extravasation with all its dangerous sequelæ. The puncture wound, thus put into a condition of rest, will granulate rapidly, after which the urethrotomy wound will close readily. Another advantage of this procedure is that it permits a thorough exploration of the wound and the bladder for foreign bodies—pieces of clothing, etc.—which may have been carried in, and which, if not removed, may form the nucleus for the development of a stone, and, later, an operation will be required for its removal. This complication is by no means rare.

*Intraperitoneal Wounds.*—A wound of the bladder communicating with the peritoneal cavity is a positive and urgent indication for (1) immediate laparotomy and exposure of the rent in the peritoneum and bladder; (2) closure of the wound by sutures; and (3) removal of the urine, blood, and foreign bodies, if present, from the peritoneal cavity. The details in carrying out this line of treatment will vary with the individual operator, but there is at present among surgeons a very general agreement as to the main points in the treatment as outlined above.*

---

* It is a curious fact that the idea of suturing wounds of hollow viscera was so tardily taken up by surgeons and put into general practice. This was due undoubtedly to the fact that in the preantiseptic period the open-

The obvious advantages of this procedure are:

(1) It permits a careful inspection of the bladder and an examination of the peritoneal cavity for extravasation of

---

ing of the abdominal cavity was followed by a frightfully high mortality. The dangers of abdominal section were so great as to deter the boldest from performing this operation for the purpose of the proper repair of laceration of the intra-abdominal organs. In the case of intraperitoneal wounds of the bladder, Sir Benjamin Bell is generally given the credit of having been the first to advise suture of the wound as early as 1789. According to Vincent, Jacob Woyt advised the closing of bladder wounds by sutures long before the time of Bell—as early as 1716. However this may be, it is pretty certain that this procedure was first carried out in man by Willet, "Abdominal Section in a Case of Ruptured Bladder," *St. Bartholomew's Hospital Reports*, 1876, vol. xii, p. 209. Willet's case was operated on thirty-six hours after injury. Symptoms of peritonitis were present. Furthermore, the continuous suture which was used slipped. This patient died. The second case, operated on by Heath forty hours after injury, also ended fatally. In this case, also, the suturing was faulty, and extravasation of urine and blood into the peritoneal cavity continued after the operation. This case of Heath precipitated a long discussion before the Royal Medical and Chirurgical Society of London as to the methods of treatment which should be adopted in these cases. There was little unanimity of opinion among the surgeons as to the proper course to be followed. Willet was severely criticised by his confrères for the method which he employed, but he stoutly defended his views, and expressed the opinion that the operation as carried out by him, if performed in time, was the only rational treatment to be employed. Holmes held the same view. Finally, Morris seems to have ended the controversy by declaring in favor of Willet's view as follows: If the wound is intraperitoneal, employ the method of Willet, that is, immediate laparotomy and suture; if extraperitoneal, cystotomy suffices.

Vincent, in an article in *Revue de Chir.*, 1881, gives the result of some important experiments undertaken by him for the purpose of determining the value of immediate suture in intraperitoneal wounds of the bladder. These include puncture wounds, single and double; lacerations; double perforations with bullets; and resections of portions of the bladder. In these experimental cases the wounds were closed by interrupted suture at varying intervals after the injury. From these experiments he concluded that *immediate* operation is essential; the wound of the bladder should be closed by interrupted sutures. In every case where the operation was done early, good results were obtained.

Vincent, calling attention to the fact that Walther, of Pittsburg, was the first and only one who had saved a patient with intraperitoneal wound of the bladder, continued: "His example must be followed with greater confidence since we possess to-day the antiseptic methods of Lister.

blood and urine, foreign bodies, and injuries to the intestines.

(2) The wound in the bladder can be tightly closed by sutures, thus preventing the further escape of urine into the abdominal cavity,—in other words, to remove the cause of the mischief. Extravasated urine and blood-clots can also be removed, and a thorough abdominal toilet performed. Injuries to the viscera, when present, may be repaired, thus avoiding the dangers of serious and even fatal complications from this source.

The rent in the bladder and peritoneal covering having been exposed, it should be closed by a row of interrupted sutures. Fine silk is the best material to use. A continuous suture should not be used, as there is danger of its slipping, and the closure is not so perfect. This accident happened in the first two cases in which suture of a bladder wound was employed. A careful toilet of the abdominal cavity should be made, removing the urine and blood, and a thorough search made for foreign bodies. It is safer to drain the abdominal wound for a few days by means of a small gauze wick. A retention catheter should be worn for a few days. This removes the urine promptly, avoids distention of the bladder and pressure on the sutures, and allows the healing of the wound to progress rapidly. In cases of double perforation, where the second wound is extraperitoneal, this should be thoroughly cleansed and lightly packed with gauze.

The statistics for intraperitoneal puncture wounds of the bladder are far from satisfactory, but they are improving, as shown by the tables above. With prompt intervention, the majority of these cases which were formerly invariably fatal should be saved. The same statement is also true of intraperitoneal rupture of the bladder. In a recent article of Seldowitsch, thirty-nine cases of recovery after intraperitoneal rup-

---

Under the leadership of Lister, this method has introduced a new era into surgery in general; the surgery of the bladder must not be excluded from its benefits."

ture of the bladder, collected from various sources, are reported.

It is only by promptness and thoroughness in our treatment that we can hope that in the future a larger number of these desperate cases will be saved.

Since completing the above tabulation, two additional cases have been found and may be added here.

1. DOUGLAS, in the *Southern Practitioner*, Nashville, 1894, vi, 13, in a paper on the recognition and management of wounds of the urinary bladder, reports the following case of extraperitoneal wound of the bladder.

A boy, aged thirteen years, was seated in an open vehicle; a horse attached to a buggy ran into him from the rear. In the collision he was thrown forward, the shaft of the buggy striking him just to the right of the coccyx. He was rendered insensible. The first complaint was of hypogastric pain and an urgent desire to urinate. Examination under an anæsthetic revealed an irregular circular wound just to the right of the coccyx near the anal margin. The shaft had entered at this point, lacerating the fibres of the sphincter, pushing aside the rectum, and penetrated the base of the bladder. Digital examination showed that the bladder was otherwise intact. The wound was packed with gauze. On the third day there was abdominal tenderness and tympany with a temperature of 102° F. These symptoms gradually disappeared. Healing was rapid, the patient being discharged well in five weeks.

2. In the *St. Petersburger Med. Wochen.*, 1903, No. 17, p. 29, occurs a brief abstract of a case reported by ARONSTAMM in the *Woenno Medicinski Shurnal*, November-December, 1902, under the title, "Ein Fremdkörper der Harnblase der durch eine Wunde wer Blasenwand eingedrungen ist."

The abstract reads as follows: A blade of straw was carried into the bladder by an injury with a pitchfork. By the contraction of the bladder, the straw stuck into the bladder walls, causing marked irritation, frequent urination, and cloudy urine. One end of the straw protruded into the urethral opening. By gentle massage the straw was gradually removed per urethram. The wound in the bladder healed without direct surgical intervention.

## BIBLIOGRAPHY.

Bartels. Die Traumen der Harnblase, Arch. für klin. Chir., 1878, xxii.
Larrey, D. J. Mémoires de Chir. Milit. et Campagnes, Tome iv.
Maltrait. Thesis: Contribution a l'etude des traumatismes de la vessie. Paris, 1881.

Otis. Medical and Surgical History of the War of the Rebellion. Surg., Part II, Washington, 1876.
Vincent. Plaies penetrant intrap. d. l. vessie. Revue de Chir., 1881.
Wichmann. Thesis: Die Stichverletzungen der Harnblase, Berlin, 1895.
Winkler. Moderne Behandlung der Blasenwunden. Thesis. Breslau, 1888.

The above list contains the most important articles. No attempt has been made to give a complete bibliography. References to the cases collected are given in the last table.

## SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER.

| No. | Reporters. | Sex. | Age. | Instrument. | Entrance Wound. | Prominent Symptoms. | Perforation. | Operation. | Result. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Beach. Boston Med. and Surg. Jour., 1879, c. 878..... | M. | 16. | Portion of window sash. | Anus, rectum. | Hæmorrhage. | Extraperitoneal. | None. | Recovery in 27 days. | Laceration of bladder just above prostate admitted two fingers spread apart half inch. |
| 2 | Quoted by Beach. Patient of Bucé, of Slough. Boston Med. and Surg. Jour., 1879, c. 878..... | M. | 46. | Stake driven into earth. | Anus, rectum. | Intense pain. | Extraperitoneal. | None. | Recovery in 2 months. | Laceration in bladder immediately behind prostate. |
| 3 | Boston Med. and Surg. Jour., 1879, ci, 738.... | M. | 32. | Cart stake, 14 in. long, 2 in. diam. at base. | Posterior to anus, rectum. | ..... | Extraperitoneal. | None. | Recovery in 6 weeks. | Bladder wound near neck. |
| 4 | Treves. Med. Times and Gazette, 1879..... | M. | 23. | Sailor's knife. | Left buttock. Lesser sacrosciatic notch. | No symptoms first 12 hours. Vomiting. Abdominal pain. Acute peritonitis. | Extraperitoneal. | None | Died in 5 days. | Extravasation of urine. Peritonitis. No bladder symptoms. |
| 5 | Stokes. Trans. Acad. Med., Ireland, Dublin, 1883, i, 88–94..... | M. | 16. | Handle of forger's tongs. Fall. | Anus and rectum. | Bloody urine. Peritonitis. | Double: Extraperitoneal. Intraperitoneal. | None. | Death in 74 hours after injury. | Pierced trigone, and perforation of fundus of bladder to left of median line. |
| 6 | Jackson. Lancet, 1883, i, 231..... | M. | 24. | Trolley such as railroad porters carry. Fall. | Rectum. | Suprapubic pain. Pain in rectum. Bloody urine. | Extraperitoneal. | None. | Recovery in 28 days. | Rent in bladder, 1 inch above prostate. Sphincter ani paralyzed and dilated. |
| 7 | Galler. Aertzl. Int. Bl. München., 1884, xxxi, 123..... | M. | 24. | Knife. Stab-wound in lower abdomen. | Left inguinal canal. | Blood and urine from wound. Peritonitis. | Extraperitoneal. Intraperitoneal? | None. | Recovery. | Retention of catheter. Galler thinks wound intraperitoneal, but history not conclusive. Probably extraperitoneal. |
| 8 | Panizo. Rev. Med. de Sevilla, 1886, ix, 97... | M. | (?). | Incised wound. | Hypogastrium, two fingers above symphysis. | Bloody fluid from wound. Local peritonitis. | Intraperitoneal. | Cystotomy. Suture of bladder and peritoneum, with interrupted catgut. | Recovery in 3 months. | Large abscess formed abont site of wound. Wound in peritoneum 6 centimetres long. |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Livon. Marseille Med., 1886, xxiii, 706..... | M. | 40. | Knife. Stab-wound. | Little to left median line, 3 cm. above pubis. | Hæmaturia through wound. | Extraperitoneal. | None. | Recovery in 12 weeks. | ..... |
| 10 | Fiorani. R. 1st. Romb. disc. é lett., Rendic Milano, 1888, 2–5, xxi, 700..... | M. | 33. | Knife stab. | Right genitocrural fold. | Bloody urine; tenesmus; sense of fulness in pelvis, local peritonitis. | Extraperitoneal. | Suprapubic cystotomy (?). | Recovery. | Abscess formed in hypogastrium after healing of operative wound. Complete recovery in about four months. |
| 11 | Hensgen. Deutsche Med. Woch., 1893, xix, 592..... | M. | 17. | Three-cornered file. Fall. | Through sacrum 10 cm. above anus. | Localized peritonitis. Bloody urine. | Extraperitoneal. Intraperitoneal (?). | None. | Recovery. | Local peritonitis supposed to be due to intraperitoneal wound, *i.e.*, file entered above peritoneal reflexion. |
| 12 | Bacchi. Gazz. Med. Cremonese, Cremona, 1894, xiv, 2–5..... | F. | 22. | Piece of wood from a fall. | Right groin. | Hæmorrhage from wound. Tumor in pelvis. Bloody urine. | Extraperitoneal (?). | Suprapubic cystotomy, closure of two wounds by interrupted sutures. | Recovery in 6 weeks. | Phlegmon resulting from infection at time of accident. |
| 13 | Soulié. Marseille Med., 1895, xxxii, 164–9. .... | M. | 20. | Knife thrust entering buttock. | Small sciatic notch. | Hæmaturia. | Extraperitoneal. | Suprapubic cystotomy. | Recovery. | ..... |
| 14 | Hamilton. Indiana Med. Jour., 1895–6, xiv, 229..... ..... | M. | 16. | Corn-stalk stub. Fall. | Anus and rectum. | Involuntary stools. Bloody urine. | Extraperitoneal. | Edges of wound sutured. | Recovery in 2 to 3 weeks. | External wound; 1½ inches, extending to anal margin. Laceration of sphincter. |
| 15 | Monitor Med., Lima, 1896, xi, 54–56. Odriozala..... | M. | 34. | Fell on a piece of cut cane. | Anus and rectum, no external wound. | Liquid stools with blood and urine. Abdominal fascies. | Extraperitoneal. | None. | Recovery in 2 months. | Vesicorectal fistula. Cellulitis in left iliac fossa. |
| 16 | Delageniere. Arch. Prov. de Chir., Par., 1898, vii, 240..... | M. | 34. | Picket in fence. Fall. | Perineum left side, 4 cm. long from ischium towards root of scrotum. | Bloody urine. Shock. | Double: Extraperitoneal. Intraperitoneal. | Following morning, laparotomy; suprapubic cystotomy. | Recovery in 2 months. | ..... ..... |
| 17 | Alsberg. Münch. Med. Woch., 1898, xlv, 79. | M. | 9. | Iron picket. | Inner side of thigh, 10 cm. below inguinal fold. | ..... | Double: Extraperitoneal. Intraperitoneal. | Laparotomy 18 hours after injury. | Recovery in 20 days. | Case unique. |
| 18 | Dodd. Brit. Med. Jour., Feb. 24, 1900..... | M. | Adult. | Bar of iron. Fall backward. | "Buttock," 2 in. above anus. | Bloody urine. | Extraperitoneal. | None. | Recovery. | Pieces of clothing in wound. |
| 19 | Gross. Rev. Med. d. l'est, 1901, xxxiii, 487. | M. | 24. | Stake. Fall, height 3 metres. | Perineum. Rectum not entered. | Absence of symptoms till onset of peritonitis. | Double: Extraperitoneal. Intraperitoneal. | Median laparotomy. | Death. | Foreign bodies carried into abdominal cavity set up peritonitis. These overlooked at operation. |

## SYNOPSIS OF CASES OF PUNCTURED WOUNDS OF THE BLADDER.—Concluded.

| No. | Reporters. | Sex. | Age. | Instrument. | Entrance Wound. | Prominent Symptoms. | Perforation. | Operation. | Result. | Remarks. |
|---|---|---|---|---|---|---|---|---|---|---|
| 20 | Weischer. Cent. f. Chir., 1901, xxviii, 127. | M. | Adult. | Scythe, struck by companion in quarrel. | Gluteal region. Foramen ischiadicum magus. | Blood and urine from wound. | Extraperitoneal. | None. | Recovery. | Wound 7 cm. long between left posterior inf. spine ilium, and trochanter. Drainage with rubber tube. |
| 21 | Tuffnell. Proc. Path. Soc., Dublin, vol. iv, 512..... | M. | 20. | Pitchfork tine. Fall. | Anus and rectum. | Bleeding from bowels. All urine passed per rectum after injury. | Extraperitoneal. | None. | Died in 5 days. | Autopsy: Extravasation of urine. Prostate split into two equal parts. Perineum not injured. Local peritonitis. |
| 22 | Birket. Holmes' Surgery..... | M. | ..... | Sharp stake driven into ground. | Anus and rectum. | Intense pain. | Extraperitoneal. | ..... | Recovery. | Quoted by Stokes. |
| 23 | Jawdynski. Gaz. lek., Warszawa, 1890, 2, s, x, 626-653..... | M. | 36. | Knife stab in a quarrel. | Right buttock. | Hæmorrhage from the wound. Retention of urine. | Extraperitoneal. | Ligation of artery. Partial closure of wound. Drainage. | Recovery in 3 months. | No complications. Wound healed by granulation. |
| 24 | Rosenbaum. Protak. Zasaid. Kavkazsk. Med. Obshtsh., Tiflis, 1890-91, xxvii, 555-564. | M. | 29. | Dagger wound. | Left inguinal two fingers above Poupart's ligament. | Prolapse of bowel. Collapse. Bloody urine by catheter. | Intraperitoneal. | Suture of bladder. | Recovery in 2 months. | Prolapse of omentum and bowel. Excision of portion of omentum. Abscess complication. |
| 25 | Evans..... | M. | 18. | Fell on slat. | Anus and rectum. | Shock. | Double: Intraperitoneal. Extraperitoneal. | Laparotomy. Repair of perineum. | Recovery in 2 months. | Omentum protruding from perineal wound. Immediate laparotomy, suture of bladder, and later repair of perineum. |

# DISLOCATION FORWARD OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS OF THE AXIS.

BY JAMES A. KELLY, M.D.,
OF NEW YORK CITY.

THE high mortality following dislocations and fractures of the cervical vertebræ, the few cases reported in the literature, in which the lesion was only demonstrated to a certainty after death, and the fact that in those cases which survive the condition is not always recognized, leads me to report the following case of dislocation forward of the atlas with fracture of the odontoid process of the axis. The case was observed while I was house surgeon at the Boston City Hospital, on the service of Dr. Hayward W. Cushing, to whom I am indebted for the permission to report this rare and interesting case.

The condition recognized clinically was proven without a doubt by the X-ray photograph, and the case is remarkable by the fact that there were at no time any symptoms of pressure on the spinal cord, that the patient so far recovered as to be able to continue a life of activity, and at the time of the writing of this article (January, 1905), he is able to perform manual labor in spite of the deformity present.

The history in brief is as follows:

C. F., aged forty-seven years, was admitted to the Boston City Hospital, April 17, 1904. The police who brought the patient to the hospital stated that he was arrested while intoxicated, and that on entering a cell he fell, striking his head on a sharp corner, receiving a scalp wound, for the treatment of which he was brought to the hospital. On admission the physical examination showed a man who, while moderately intoxicated, was perfectly conscious. A scalp wound about two inches in length, not exposing the bone, was present over the left parietal region. The head, held rigidly, was in a position of extreme dorsal flexion,

and rotated slightly to the right, the chin being depressed upon the chest. There was moderate muscular spasm of the neck muscles. Over the posterior aspect of the upper cervical vertebræ there was marked swelling and tenderness. No crepitus could be elicited, but through the swollen tissues there could be felt apparent marked prominence of the spinous process of the axis, and there was an increase in the distance from this spinous process to the occiput. The patient complained of considerable pain localized to the seat of the swelling, which was increased on lying down. On this account he preferred the sitting position. There were no symptoms of motor or sensory paralysis. The scalp wound was irrigated and sutured. On account of the local tenderness in the post upper cervical region, and the marked deformity, a clinical diagnosis of probable dislocation forward of the atlas with fracture of the odontoid process of the axis was made, and, in the absence of any symptoms of pressure upon the spinal cord, the treatment consisted in supporting the head with a rigid, well-fitting felt collar, and placing the patient in a semirecumbent position upon a "head rest." On the day after admission an X-ray photograph was taken, which, confirming the clinical diagnosis, showed in the lateral view a well-marked dislocation forward of the atlas (Fig. 1). It was thought at the time that, on account of the absence of pressure symptoms, there was probably a fracture of the odontoid process of the axis in combination with the dislocation. The patient being comfortable, and in the absence of pressure symptoms, no efforts were made to reduce the dislocation, the support given by the felt collar being considered sufficient to make the patient comfortable, and prevent any increase in the extent of the dislocation.

April 21. Since entrance the patient has developed no symptoms of pressure upon the spinal cord. He is more comfortable when semirecumbent upon a "head rest," or when sitting up. The collar used at the time of entrance gives perfect support to the head. Examination of the back of the neck shows slight fading ecchymosis and marked diminution in the size of the swelling, rendering palpation of the spinous processes of the cervical vertebræ more easy. Considerable tenderness is present over the swelling. There is apparent marked projection of the spinous processes of the cervical vertebræ from the second downward, which is due to the forward position of the atlas and head,

to the dorsal flexion of the latter, and to the increased distance between the spinous process of the axis and the occiput. There is still moderate rigidity of the neck muscles, the head remains slightly rotated to the right, and, while normal rotation is lessened, it is possible to left and right. Flexion and extension are markedly diminished. The scalp wound is healing by primary intention.

April 25. Local tenderness is still present. There is no change in the extent of rotation, flexion, or extension. There have developed no symptoms of pressure. The sutures were removed to-day from the scalp wound, which has entirely healed. The felt collar is still giving sufficient support to the head.

April 29. The local tenderness is decreasing. There is no change in the bony contour of the cervical vertebræ. Dorsal flexion of the head is still marked. Limitation of motion remains the same as last noted.

May 3. The patient's general condition is much improved. The local condition remains unchanged, excepting that the tenderness has almost disappeared. Yesterday, the patient was allowed to be up in a chair for a short time, and to-day was up in a chair for several hours.

May 7. The patient was allowed to be up and about the ward to-day. All swelling and tenderness of the back of the neck have disappeared. The head is still held in a dorsally flexed position. Anteroposterior movements and rotation are not so restricted, but are markedly diminished. The use of the felt collar is continued.

May 12. The patient has been up and about the ward during the greater part of the day since the last note, and has not complained of any symptoms, either local or general. Examination shows the posterior aspect of the neck and occipital region to be almost a straight line, the normal curve, formed by the junction of the posterior surface of the neck and the occiput, being obliterated. The spinous processes of the cervical vertebræ from the axis to the seventh are in a normal line, that of the axis being prominent on account of its altered relation with the occiput, and the distance between it and the latter being still greater than normal. The head remains in a position of dorsal flexion, anteroposterior motion and rotation are still diminished. The use of the felt collar is continued. The patient desires to go home, and, as there have never been any symptoms of pressure on the spinal

cord, and as he agrees to remain under observation in the out-patient department, he is discharged relieved.

Condition of patient, January 18, 1905. The patient states that he has been employed since leaving the hospital. His work consists of carrying "pig iron" and other heavy objects. He complains of some slight pain in the left side of the neck after doing a hard day's work. He has never had any symptoms of motor or sensory disturbances, anæsthesia, or neuritis. No difficulty in swallowing.

Physical examination shows the head to be held in a slightly flexed position, although the range of flexion and extension is practically normal. Rotation to the left is normal, to the right is limited to 10 to 15 degrees from the median line. The deformity in the neck still exists. The spine of the axis is very prominent. Between the spine of the axis and the occiput there is a depression due to the forward displacement of the atlas, the posterior arch of the latter being felt in the depression about one-half to three-quarters of an inch anterior to its normal position. Examination of the pharynx shows the posterior wall slightly prominent in the region of the atlas.

Since leaving the hospital, the patient has not used any supporting apparatus, and, excepting for the pain occasioned by heavy work, has had no inconvenience as a result of his injury.

The X-ray photograph (Fig. 1) demonstrates the lateral view of the dislocation. It shows that the head is markedly flexed, and that this abnormal flexion takes place at the atlo-axoid junction, being due to a dislocation forward of the atlas upon the axis. Comparison with the X-ray photograph (Fig. 2) of a normal head and neck shows this forward dislocation. The line of the anterior surfaces of the bodies of the cervical vertebræ is normally a straight one, from the base of the skull downward, while the X-ray photograph of the dislocation shows that this straight line is abruptly broken at the junction of the atlas with the axis. The horizontal planes through the bodies of the cervical vertebræ normally are practically parallel, whereas the X-ray photograph of the dislocation shows that the horizontal plane through the atlas (*c*, *d*)

FIG. 1.—Forward dislocation of atlas upon the axis, with fracture of odontoid process of the axis.

FIG. 2.—Skiagram showing normal relations of upper cervical vertebræ and the occiput.

forms a marked angle, with the horizontal planes through the other cervical vertebræ (*e*, *f*, *g*, *h*, etc.). The photograph also shows an increased distance between the point *b*, the spinous process of the axis, and the point *a*, the nearest point of the occiput, than occurs normally. It also shows that the normal angle formed by a vertical plane through the bodies of the cervical vertebræ and a horizontal plane through the skull is markedly altered. (For the purpose of distinctness and explanation, the outlines of the vertebræ and the skull have been made.)

On account of the intimate relations existing between the two upper cervical vertebræ and the medulla oblongata, and their position above the roots of the phrenic nerves, and also above those of the other nerves supplying the muscles of respiration, dislocation or fracture of the atlas and axis is extremely dangerous. While in all cases the condition is not immediately followed by fatal results, yet the secondary changes which may take place, as hæmorrhage, inflammation, and sudden displacement due to incautious movements, usually produce death. The differentiation between dislocation and fracture without the use of the X-ray is extremely difficult, as the symptoms of the two conditions are usually the same. In dislocation forward of the atlas without fracture of the odontoid process of the axis, it is to be assumed that sudden death invariably results, on account of pressure on the medulla oblongata by the odontoid process of the axis, and the posterior arch of the atlas. When death does not occur, following forward dislocation of the atlas, the odontoid process of the axis must be fractured and carried forward by the unruptured transverse ligament.

In studying the anatomical relations between the atlas and the axis, we find that the articulation is formed not only by the lateral articulations as in the other vertebræ, but also by that between the odontoid process of the axis and the anterior arch of the atlas. This process is placed vertically behind the anterior arch of the atlas, and is firmly held in place by the transverse ligament of the atlas, by the two alar ligaments which

pass from the base of the process to the occipital bone, and by the vertical extension of the transverse ligament, the suspensory ligament, and the posterior occipito-axial ligament.

In forward dislocation of the atlas, the following three conditions are possible: (1) A fracture of the odontoid process of the axis; (2) a rupture of the transverse ligament of the atlas; and (3) a slipping of the odontoid process beneath the transverse ligament. If the two latter conditions occur in combination with the forward dislocation of the atlas, the resulting pressure on the medulla oblongata caused by the intact odontoid process and the posterior arch of the atlas will cause sudden death, on account of the resulting space being insufficient to accommodate the medulla oblongata. When the odontoid process is fractured along with the dislocation forward of the atlas, it is carried forward with the anterior arch of the atlas by the transverse ligament, dangerous compression is not necessarily produced, and the condition need not prove fatal if further displacement, compression from hæmorrhage, or inflammation does not occur, and sufficient time is given for repair to take place.

This repair may occur in fracture of the odontoid process as in that of fracture of the other vertebræ, by callus formation, which may remain fibrous or later become bony. If the displacement is not reduced, callus is formed at the seat of fracture, and ultimate union will occur between the fragments in their altered position. After a time the projecting angles and excessive callus become absorbed and ossification becomes complete, so that aside from the deformity the bony parts should become as rigid as before injury.

Figs. 3, 4, 5, and 6 are photographic reproductions of anatomical preparations of the three possible conditions that may occur with dislocation forward of the atlas. I am indebted to Dr. G. G. Davis, of the University of Pennsylvania, for the facilities afforded to me in making the anatomical preparations.

*Conclusions.*—The diagnosis of dislocation forward of

FIG. 3.—Vertical anteroposterior section showing normal relations of medulla oblongata, atlas, and axis.

FIG. 4.—Vertical anteroposterior section showing rupture of transverse ligament and pressure on the medulla oblongata by the odontoid process of the axis and posterior arch of the atlas. Posterior atlanto-axoidean ligament being ruptured.

FIG. 5.—Vertical anteroposterior section showing dislocation forward of the atlas with fracture of the odontoid process, the latter being carried forward by the transverse ligament and no pressure being produced on the medulla oblongata. The posterior atlanto-axoidean ligament being ruptured.

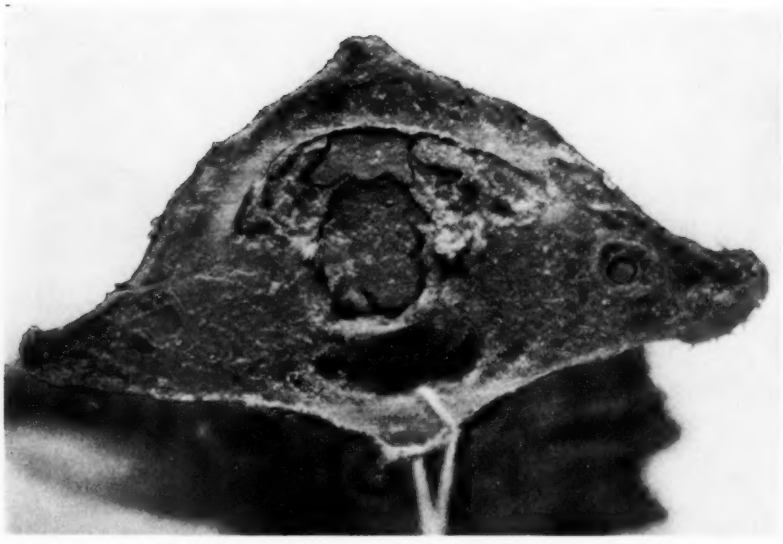


FIG. 6.—Cross-section through atlas showing transverse ligament in front of odontoid process of axis and pressure upon the medulla oblongata by the odontoid process and posterior arch of the atlas.

the atlas upon the axis with fracture of the odontoid process of the latter, in this case, is based upon the following:

(1) The history of injury and the clinical symptoms demonstrated the condition.

(2) The X-ray photograph demonstrated the dislocation.

(3) The absence of pressure symptoms prove conclusively that a fracture of the odontoid process must have been present in combination with the dislocation.

(4) The anatomical preparations show that pressure upon the cord would have occurred unless the odontoid process had been fractured.

# A NEW INTERDENTAL SPLINT FOR FRACTURES OF THE LOWER JAW.

BY RAYMOND RUSS, M.D.,
OF SAN FRANCISCO, CALIFORNIA.

LOOKING over the many forms of interdental splints which have been proposed for the treatment of fractures of the lower jaw, we find that they may be roughly grouped into the following four classes:

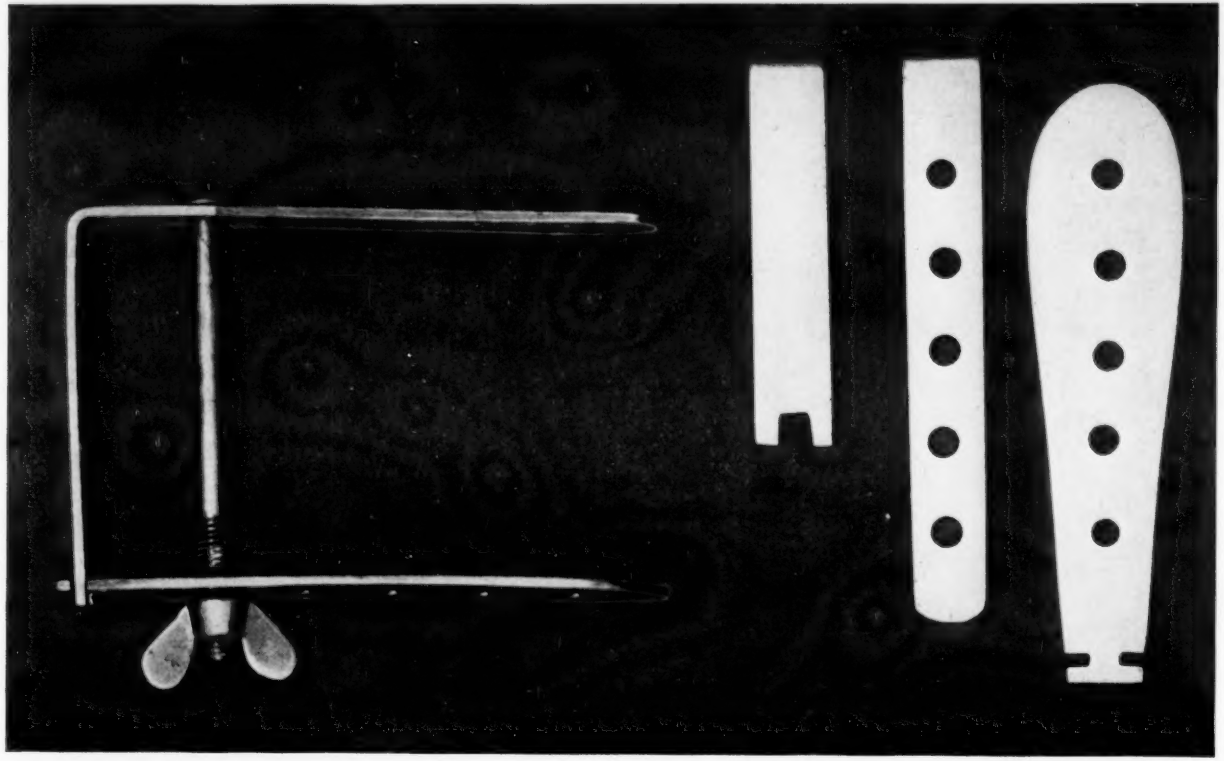
1. Those in which support is derived from the upper and lower teeth, the apparatus fitting as a wedge between them, as in the splints proposed by Lederer, Fuller, Ottolengui, and others.

2. Those in which reduction is maintained by a single splint fastened to the lower teeth as in the methods of Angle and Löhers, or the interdental wire splints of Hammond, Sauer, Claude Martin, of Lyons, or a silver clasp over the crowns of the teeth as employed by Mütter, or steel plates fitted along the anterior and posterior curvatures and retained by a steel clasp as proposed by Nicole.

3. Those in which an interdental plate is held in position by straps, attached to long arms projecting from the plate, as in the apparatus of Kingsley, Gunning, Marshall, and Truman.

4. Those in which there is both downward (interdental) and upward (chin) pressure, as exhibited in the splints of Wales, Sudduth, Lonsdale, Bullock, Moriarty, Ackland, and Matas. Such splints are far to be preferred, for they hold the fractured parts much firmer than the other methods mentioned.

But, as we look over the field of fracture work, we can find hardly a single appliance among the elaborate ones which have been proposed which is still in general use. Nearly all have been relegated and clinical methods of work have taken their places. This is especially true of the various pieces of



The Clamp. Short Arm. Long Arm. Chin-Piece.

FIG. 1.—The clamp and its parts (natural size).

apparatus for fracture of the mandible. Many of them have been applied successfully by their originators, but have never been generally accepted. Some require a skilled dentist for their application, making them impracticable for clinical work, and thus greatly limiting their field.

It has seemed to me that a splint for this fracture, in order to obtain the greatest degree of usefulness, should fulfil the following requirements:

It should hold the fracture with absolute firmness. It should allow of free use of the lower jaw so as not to interfere with speech or the taking of food. It should not so cover the teeth as to prevent free cleansing of them with antiseptic solutions, for, as these fractures are very likely to be open, oral sepsis is the greatest danger which confronts the surgeon. The splint should be readily accessible to any practitioner doing surgical work. He should be able to make it, if necessary, with the materials at hand, combined with such mechanical assistance as any small town or hamlet may afford. He should be able to apply the splint, if necessary, without professional assistance. As it is not possible in many cases for the patient without force to open his jaws but a slight way after the receipt of the injury, thus preventing the taking of impressions or the moulding of a mouth-piece, the splint should meet this need. It should be worn with comparative comfort, and should not become loosened when the patient assumes his usual sleeping attitude. It should be capable of quick removal for purposes of inspection and rapid readjustment.

The apparatus which I am about to describe meets these requirements. It cannot be used in all cases of fracture of the lower jaw. It is out of the question in fractures of the rami or of the condyloid or coronoid processes, or in those cases of severe comminuted fractures such as are met with in railway surgery or in gunshot injuries. Looking over my records, I find, however, that I could have employed it advantageously in about 90 per cent. of my cases.

This splint is made of spring brass $^{3}/_{64}$ of an inch in thickness and shaped as shown in the accompanying illustration

(Fig. 1). Each clamp consists of two parts, a chin-piece and a piece bent at right angles, making a long and short arm. The chin-piece is wider at one end to prevent its slipping when incorporated into the plaster-of-Paris dressing. It is 8 centimetres long, and provided with a number of holes so that the plaster-of-Paris may sink into them, thus making the dressing more secure. The right-angled piece is 1 centimetre wide, while the arms measure 7½ centimetres and 5 centimetres respectively. The end of the short arm is provided with a simple lock which fits into a corresponding lock in the chin-piece. Three or four holes should be bored into the long arm.

When these two parts are locked, they form a clamp which permits of easy adjustment. This adjustment is accomplished by means of a round head brass machine-screw 6 centimetres in length and carrying a winged nut. This fits into holes in the long arm and the chin-piece at 1½ centimetres distance from the short arm. Such a splint is easily and quickly constructed by any gunsmith or locksmith. After the clamp has been made, it should be heavily nickel plated. The making and plating of the splint will require one day. The clamp as above described has been found to be applicable to thirty-five out of fifty adult jaws. For the other cases, a splint with a short arm of 5½ centimetres answers.

In the absence of proper material, the following plan may be adopted. Tool steel of 1.2 centimetres width is employed. This is shaped as above described, with the exception that the chin-piece is of the same width throughout its extent. If the screws and nuts are not to be obtained, the parts can be fastened together with wire. The apparatus is clumsy in appearance, but answers the purpose very well. I employed it with excellent results in my first case.

The splint is applied with the patient lying in the dorsal position upon the operating table. The face is cleanly shaven and the fracture reduced. A thin layer of felt or layers of sheet wadding are then fitted neatly over the chin and under the jaw, extending as far back as the rami. Over this a plaster-of-Paris bandage is carefully folded, the operator rubbing the

FIG. 2.—The interdental splint in position.

plaster well in as he proceeds. The bandage is carried back on each side to the ramus, where the turns are held by an assistant or by the patient. When the jaw is well covered the splints are applied, the parts being held together by the screws and nuts. The long arms are placed directly over the molar and biscuspid teeth, extending as far back as the last molars and emerging at the corners of the mouth. The chin-pieces are pressed into the plaster. They should run along the body of the jaw. The apparatus being in position, a few more turns of the bandage are taken and the dressing completed by rubbing in dry plaster-of-Paris. Accurate coaptation is desired.

When dry, the chin-pieces are detached from the interdental portions and the plaster-of-Paris dressing removed and trimmed to the desired shape. The dressing is then reapplied to the jaw. The interdental portions of the splints, together with some dental compound, such as is commonly used by dentists in taking impressions, are thrown into hot water. When sufficiently softened, the dental compound is applied along the under surface of the interdental arms, and these are quickly placed upon the teeth, in the same position as in the first application, and pressed firmly down so that the splints rest upon an even bed, the dental compound filling up the holes which have been bored into the long arms. The short arms are then locked to the chin-pieces, the screws reapplied, and the apparatus tightened by means of the winged nuts.

The application of the apparatus requires but little skill, and can easily be done with no other assistance than that which the patient can furnish. If properly made, uniform pressure will be exerted by the plaster-of-Paris cap and no excoriations of the skin will result. By means of the action of the two parallel lines of force, each splint holds its half of the mandible as in a vise, while spreading is prevented by the closely fitting plaster-of-Paris dressing (Fig. 2). Firm pressure upon the molar teeth, so necessary in the treatment and in the retention of the apparatus, is exerted. My first case was one of open fracture between the right canine and the second incisor in which great mobility existed. The fracture, after being in-

effectually treated for six weeks by other methods, was firmly united after this splint had been in position three weeks. The apparatus furnishes a quick and ready method of treatment, and my experience with it thus far has been most satisfactory. In one instance I applied the splint to a most irregular set of teeth. As in these cases there is danger of the apparatus loosening, allowing the long arms to slip off the molars, it will be best to so construct the splint as to leave several tabs projecting from the long arms. These can be turned down at right angles, thus making the dressing perfectly secure.

In conclusion, I desire to express my thanks to Professor Harry M. Sherman, head of my department in the University of California, for valuable advice and for the clinical opportunities for study which he has given me; also to G. Edward Luce, an expert mechanic, who has been of the greatest assistance in working out the details of this splint.

# THE TREATMENT OF FRACTURES OF THE FEMUR IN INFANCY AND CHILDHOOD.

BY MARTIN W. WARE, M.D.,

OF NEW YORK,

Adjunct Surgeon to Mt. Sinai Hospital.

FRACTURES of the femur that we encounter in infancy are those produced inter partum by the accoucheur, and those in nurslings, the former the result of indirect violence during delivery, and the latter very commonly met with in rhachitic infants who sustain a slight fall or blow. Here we have to deal with indirect or direct violence as causative factors. The same holds good for children when once they are able to walk.

In the infant in arms, pain, great tenderness, and slight deformity attract attention to the fracture, which at this tender age is most commonly incomplete and of the greenstick variety. In the child able to walk, the deformity may be more marked, being decidedly angular at times and associated with false motion and crepitus. The line of fracture under these circumstances is generally transverse, consequently there is no overriding of the fragments. The angular deformity which alone accounts for slight shortening is caused by the action of the muscles, which are best made to relax by flexing the thigh and leg.

This principle of flexion of the thigh and leg is made use of in the Hodges, the Smith splint, Dunham's splint, the double inclined plane of Volkman, and the vertical suspension of Schede (Hamilton). Of these the last is widely employed in fractures of the thigh in children and yields excellent results. It, however, necessitates confinement to bed, wherefore it is a more common practice to treat infants and children with a plaster-of-Paris spica embracing the thorax and extending halfway down to the leg, or using a Nélaton splint. The weight of such an extensive plaster-of-Paris dressing, while it absolutely immobilizes the fragments, makes it difficult to carry the

infant or child about, hence it is incumbent to place the little patient on his back in bed. Furthermore, free breathing is embarrassed by reason of this constant recumbent position and envelopment of the thorax with the plaster-of-Paris or the lateral splint. With the thigh in extension the toilet of the child is nigh impossible.

The disadvantages of the various splints above enumerated are offset by the use of the device about to be described, which I have used in my service at the Good Samaritan Dispensary in forty cases up to the age of five years, and on two occasions in fractures of both femora (Fig. 2), always attended with excellent results.

The accompanying illustrations (Figs. 1 and 2) will best convey the idea of the apparatus. The device consists of a right-angled isosceles triangle constructed of one strip of bookbinder's pasteboard, the width of the triangle adapted to the width of the thigh. One length is obtained by measuring the trunk from the level of the lower angle of the scapula to the inguinal fold. The length of the other side of the right angle is the length of the thigh. The hypothenuse is always a few inches longer.

The single strip of cardboard is then bent to the shape of the desired triangle and the overlapping edges secured by adhesive plaster. The triangle may be made more rigid by reinforcing it on all sides of this inner aspect with small pieces of cigar-box wood. The outer surfaces in contact with the trunk and thigh are to be padded with non-absorbent cotton. A muslin spica secures the triangle embracing the trunk and the thigh in a flexed position. Over the muslin bandage several turns of a dextrin bandage are placed, giving additional security to the splint. The leg is left to move freely.

It is surprising how comfortably the infants may be carried about, how clean they may be kept during the three to four weeks that the splint is kept in place, and how uniformly successful the perfect healing of the fracture results.

In conclusion, I wish to assign credit for this device to the late Dr. W. W. Van Arsdale, whose experiences therewith

FIG. 1.—Combined pasteboard triangle and plaster-of-Paris spica apparatus for fracture of femur in infancy.

FIG. 2.—Apparatus for treatment of fracture of both femora.

were first made public in 1897 (*Journal of the American Medical Association*, vol. xxix, p. 1239). This confirmation of his experiences it is hoped will give an impetus to this very valuable method of treating fractures of the femur in infancy and childhood, which has an economic value in permitting the nursing of an infant and doing away with four weeks of recumbence in bed whether in hospital or at home.

# FRACTURE OF THE CARPAL SCAPHOID.

BY LEONARD W. ELY, M.D.,
OF NEW YORK.

THIS injury, formerly thought to be very rare, since the introduction of the X-ray appears to be of fairly frequent occurrence. The account of another case follows.

The patient, a telegraph lineman, thirty years old, presented himself for treatment at the Roosevelt Hospital Dispensary on June 20, 1904, and gave this history: Four weeks previously he had fallen from a telephone pole to the ground, striking on his left hip and wrist. He was carried to the hospital and presumably was treated for contusions by rest in bed for two weeks. Since then he has limped, and has had pain in his hip, and pain and disability in his wrist. He applies for treatment for his wrist.

Examination showed thickening of carpus and inability to flex or to extend the fingers. Passive extension of the middle finger was especially painful and difficult. Motion at the wrist-joint and supination of the hand were restricted.

A skiagram was taken, and some passive motion was done. The course of the case appears in the record.

June 21. Skiagram shows fracture of scaphoid and displacement of the carpus towards the radial side. The semilunar also appears to be displaced. Treatment, strapping.

June 23. Strapping removed. Daily massage and gentle passive motion prescribed.

July 12. Slight improvement. Strapping.

July 19. Strapping removed. Motion in fingers has slowly improved, but wrist is still very stiff. Ichthyol ointment and hot and cold water.

July 21. Under ether adhesions were broken up, and the wrist was moved as much as possible. Evident bony resistance to extremes of motion. Patient ordered to use hand.

July 22. Considerable reaction.

At this point the notes cease. The patient has disappeared and cannot be found. The treatment must be put down as unsat-

FIG. 1.—Fracture of the carpal scaphoid bone. Skiagraph of left wrist, the injured side.

FIG. 2.—Skiagraph of the right uninjured wrist, to be compared with Fig. 1.

isfactory, but the case seems to show the necessity for early reduction of the deformity.

## REFERENCES.

Callender. Transactions of Pathological Society of London, x, 866; xvii, 221.

Destol. Lyon Méd., 1904, cii, 529. Bull. Soc. de Chir. de Lyon, 1904, vii, 53. Lyon Méd., ciii, 315–317, 347–350, 402. Bull. Soc. de Chir. de Lyon, 1904, vii, 246–248.

Ely. ANNALS OF SURGERY, vol. xxxviii, 96.

Stimson. ANNALS OF SURGERY, vol. xxxv, 257.

Vialle. Lyon Méd., 1904, cii, 315–322. Bull. Soc. de Chir. de Lyon, 1904, vii, 11–19. Lyon Méd., 1904, ciii, 374–376. Arch. de Méd. et Pharm., Paris, 1904, xliv, 253. Bull. Soc. de Chir. de Lyon, 1904, vii, 256–259.

# TRANSMESENTERIC HERNIA OF THE APPENDIX VERMIFORMIS.[1]

BY ALFRED C. WOOD, M.D.,

OF PHILADELPHIA.

A MALE, aged twenty-two years, student, was admitted to the University Hospital, January 7, 1904. He had always enjoyed good health, with the exception of two occasions, viz., the first, four years ago, when he had an acute attack of obstinate constipation and generalized abdominal pain, lasting several days and causing him to remain in bed; the second was a similar attack, nine months before admission to the hospital, associated with influenza and lasting ten days.

About two weeks before the present illness the patient was writing almost all day, and he found, while sitting at the table, that he was comfortable only when the right side was "kinked up," as he expressed it. In this position he did not feel any unusual sensation, but as soon as he assumed a normal posture he was conscious of a distress in the abdomen. Without any other premonitory symptoms he became distinctly ill on the afternoon of January 1, about a week, therefore, after the attack just mentioned. He had headache, nausea, vomiting, and moderate pain in the epigastrium. After retiring in the evening he had a pain in the back and felt chilly, but had no distinct rigor. On the following day there were three bowel movements; the pain in the abdomen continued. There was no definite change on the third day; the bowels moved once. On the fourth day the pain was distinctly in the right lower quadrant of the abdomen. It had been continuous with occasional attacks of general abdominal pain. There was no change on the fifth and sixth days. On the seventh day, after saline purges, there were six watery stools.

The notes made on January 8 are as follows: Pulse, 88; respiration, 20; temperature range 100° to $102^{2}/_{5}$° F. The abdomen is not distended, and there is no rigidity. A rounded tender mass is felt in the abdomen, approximately two inches wide and

[1] Presented before the Philadelphia Academy of Surgery, April, 1905.

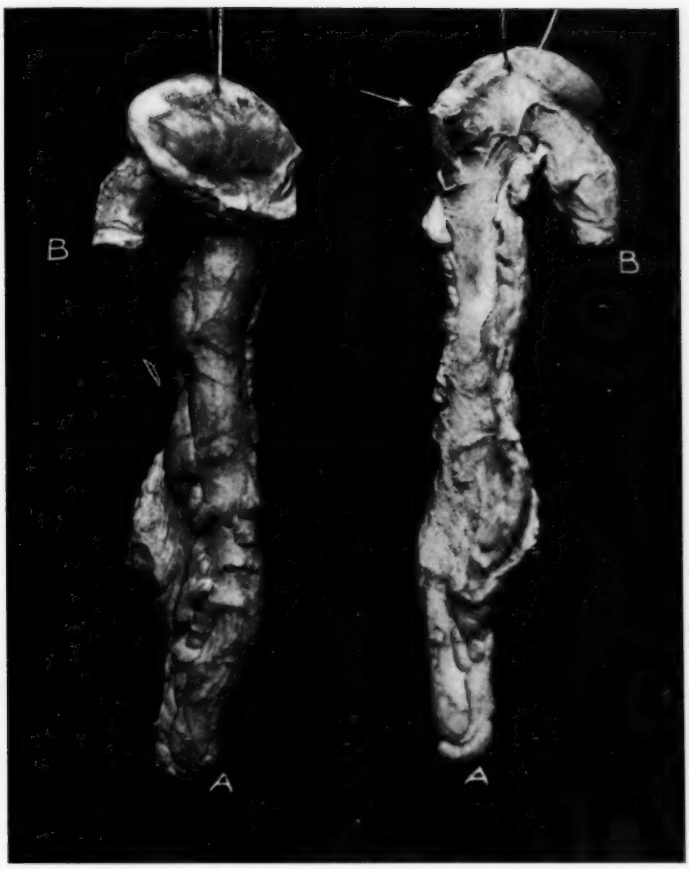



FIG. 1.—Hernia of appendix vermiformis through abnormal opening in mesentery, with strangulation. *A*, The free extremity of the appendix; *B*, the cæcal extremity; the arrow points to the perforation indicated by the small dark spot. The crown, composed of lymph, covers the portion that had protruded through the mesenteric opening.

four inches long, in the line of the ascending colon; the lower border of the mass corresponding with McBurney's point. The leucocyte count is as follows: January 8, 2 P.M., 14,640; 9 P.M., 17,920; midnight, 17,000; January 9, 9 A.M., 16,080. The urine is normal.

Although some of the features were unusual, the condition was thought to be appendicitis, with an abscess. An operation was performed, the peritoneal cavity being opened by an incision over the mass. The latter occupied the normal position of the ascending colon and had the general shape and size of this structure. It was firm to the touch and had a very deep red color. At three or four points areas of softening were seen, suggesting the beginning of breaking down in the mass. While no anatomical structure could be recognized through the incision, the mass was thought to be the colon, altered by inflammatory action and lymph formation. As the appendix could not be found, it was supposed to be in the mass described, but a careful search failed to disclose a trace of this structure. The areas of softening were found to be suppurating, epiploic appendages. By enlarging the incision the survey was extended, and finally the cæcum recognized firmly fixed in its position. The longitudinal bands could be seen here, but were obscured above. The anterior band led backward and upward, and seemed to be lost beneath the mesentery. On inspecting the opposite surface of the latter, after displacing a portion of adherent omentum, a small rounded structure was seen projecting from it. The condition at once became clear; the appendix had slipped through a hole in the mesentery and had become strangulated. It was reduced with some difficulty, owing to adhesions and the firm constriction of the ring. As soon as the appendix was liberated the unusual fixation of the cæcum was relieved. The process was removed. The opening in the mesentery, which comfortably admitted the tip of the little finger, was closed by sutures. A Mikulicz drain was inserted and the wound closed. The patient made an uncomplicated recovery.

As will be seen by consulting the illustration, the appendix was strangulated at its base, the organ having doubled upon itself and slipped into the hole in the mesentery. It had ruptured at the point of constriction. The meso-appendix was unusually large and fleshy.

In addition to the rarity of the condition, the case was inter-

esting on account of the presence of an inflammatory mass quite two inches from the affected portion of the appendix, and an apparently healthy area between. This misleading evidence prolonged and complicated the operation. The minute perforation of the appendix permitted very slow leakage, which, owing to the position of the patient, or other causes, collected on the anterior and outer aspect of the colon, and caused an inflammation of the structures with which it came in contact.

I have not been able to find any reference to similar cases, although instances of strangulation of the intestine in the same manner are recorded.

# TRANSACTIONS

OF THE

# NEW YORK SURGICAL SOCIETY.

*Stated Meeting, March 22, 1905.*

The President, HOWARD LILIENTHAL, M.D., in the Chair.

## HYDRONEPHROSIS, WITH COMPLETE DESTRUCTION OF KIDNEY PARENCHYMA DUE TO CALCULOUS OCCLUSION OF URETER; NEPHRECTOMY.

DR. CHARLES N. DOWD presented a woman, forty-nine years old, who had always enjoyed much better health than the average, had borne two children, and had attended to the ordinary duties of her household.

On admission to the General Memorial Hospital, in May, 1904, she looked vigorous and well-nourished, and said that she had felt particularly well and strong for the past few months. She felt, however, the mechanical presence of a large mass in the left side of her abdomen. On close questioning, she said that for years she occasionally had had a little backache and slight pain in the left iliac region. This mass proved to be a uronephrotic kidney sac, which was removed without difficulty, and with no constitutional after-affects nor wound complications. No kidney parenchyma could be found. The ureter of the kidney was occluded by a calculus which had been eroded in spots, apparently by chemical action. It seemed remarkable that a kidney could have been dilated so as to have its parenchyma entirely destroyed, and that its ureter could have been completely occluded without giving rise to sufficient symptoms to call the patient's attention to her condition. The process must have been gradual, the urinary flow having been hindered, but not completely stopped,

during the early stage of the condition. The cyst was nine inches long.

### PAINLESS HÆMATURIA OF FIVE YEARS' DURATION; INCISION OF KIDNEY PELVIS; CESSATION OF SYMPTOMS.

Dr. Charles N. Dowd presented a man, aged forty-nine years, who had enjoyed good health until nine years ago, when he began to suffer from painless hæmaturia. This persisted for two years, then, after ceasing for four years, it recurred, and had been continually present for the past three years. He had suffered from weakness, and had shown much pallor from the loss of blood; otherwise, there had been no symptoms, and he had been able to do light work most of the time.

When the patient came under observation on February 7, 1905, he passed a specimen of urine which appeared to be about one-fifth blood. Its color was deep red. It was submitted to Dr. Frederic E. Sondern for examination, who reported that it was acid, with a specific gravity of 1027; it contained about the amount of albumen which the blood would account for; no casts, tubercle bacilli, or cellular elements referable to the kidney could be found. There were a few bladder-cells, crystals of oxalate of lime, and a normal percentage of urea.

The patient stated that he had submitted to many forms of treatment without benefit. The hæmaturia was usually less when he was resting. An X-ray examination was negative. The cystoscope showed bloody urine coming from the right ureter. There was a projection at the right ureteral orifice which prevented the introduction of the catheter. The bladder was otherwise normal; the urine from the left ureter was clear.

Exploration of the right kidney and ureter was made February 11 through an oblique lumbar incision. The kidney was brought well through the wound so as to expose its surface and the upper part of the ureter. An opening was made into its pelvis, but this showed no evidence of blood nor other abnormality. The finger introduced into each calix failed to detect a stone or anything abnormal. A catheter was easily passed downward into the bladder. The wound in the renal pelvis was sutured with catgut, and the kidney secured in position only so far as stitches in its fatty capsule would hold it. The capsula

propria was not incised. The patient's recovery was uneventful, and he had not suffered from hæmaturia since. The urine still contained a trace of albumen and a few hyaline casts. The amount passed in twenty-four hours was 1110 cubic centimetres; specific gravity, 1017; it contained 17,338 grammes of urea, and an excess of indican.

Cases of this kind, Dr. Dowd said, were hard to explain. There was an extensive literature on the subject. Schüller, in reporting a somewhat similar case in the *Wiener klin. Woch.*, last year, carefully reviewed the subject, and maintained that there were practically always lesions in the kidneys from which these hæmorrhages came, although the lesions might be so small that they could not be detected by the naked eye. In his case he found evidences of an old inflammatory process in the kidney. In the cases he reviewed, there were, with two exceptions, evidences of inflammation of certain parts of the kidney or its capsule, or mechanical, congenital, or calcareous lesions.

Fenwick, in his monograph on "Ureteric Meatoscopy," had also considered the subject in detail. In addition to the presence of stone, of tubercle bacilli, or a malignant growth, which of course at once suggested themselves as possible causes of this condition, he referred to chronic granular nephritis and angioma or capillary nævus of a renal papilla as causes. The former, he stated, have constituted about 12 per cent. of his cases of painless hæmaturia, but, owing to the great admixture of blood, the casts and other evidences of chronic nephritis had usually not been discovered. He had never encountered a case in which both kidneys bled simultaneously. He also cited six cases of angioma of a papilla that caused the hæmaturia, and advised in such cases the removal of the papilla or the destruction of its blood-supply by rough tearing of that particular pyramid through a cortical incision.

Dr. Dowd said that nephrotomy and nephrectomy had been frequently done for painless hæmaturia. In the case he had shown, the bleeding seemed to be due to a chronic nephritis which was now showing itself in the presence of albumen and hyaline casts.

Dr. John A. Hartwell mentioned the case of a man, fifty-two years old, who, after he had been in the Lincoln Hospital for some time for chronic rheumatism, developed a severe hæma-

turia. Examination of the urine failed to show any evidences of nephritis. In the course of a few days the bleeding subsided; but there was a subsequent recurrence, and this was rapidly followed by the development of a large tumor in the region of the left kidney. He had no temperature. The leucocyte count was 22,000. An incision in the left lumbar region opened into a large hæmatoma apparently surrounding the kidney. On account of the severity of the hæmorrhage, a nephrectomy was done. A gross examination of the kidney showed small hæmorrhagic spots. After the operation, the patient was apparently progressing satisfactorily until the eighth day, when he had a profuse hæmorrhage from the wound, and died. The autopsy showed a large collection of blood in the postperitoneal region. The excised kidney was submitted to Dr. W. A. Ewing, whose microscopical examination of the organ failed to show any evidences of nephritis or throw any light on the cause of the hæmorrhage. There was nothing to show whether the blood came from the kidney or outside of it.

Dr. Howard Lilienthal said he had published elsewhere a case bearing on the subject under discussion (hæmorrhagic nephritis). The patient was a woman who was suffering from profuse hæmaturia. A suprapubic cystotomy was done, which showed that the blood came from the right ureter. A nephrotomy was immediately done, and the hæmorrhage checked by introduring a catheter into the ureter. The woman died as the result of the excessive loss of blood, and a very minute post-mortem examination of the entire urinary tract failed to show the source of the hæmorrhage. There were evidences, however, of a nephritis, and the case was apparently one of hæmorrhagic nephritis. Dr. Lilienthal said that cases were not uncommon where a hæmaturia had apparently been cured by a simple nephrotomy.

## OSSIFYING SARCOMA OF THE THIGH; TREATMENT BY INCISION, RADIUM, AND EXTIRPATION.

Dr. Howard Lilienthal presented a girl, twenty-one years old, who early in 1904 noticed a mass about the size of an egg in the upper part of the right thigh, to the outer side of Scarpa's triangle. It was neither painful nor tender, and did not interfere

with locomotion. It steadily increased in size, and the patient applied for treatment at Mt. Sinai Hospital on November 9, 1904.

The patient's family history was unimportant, beyond the fact that her mother had been operated upon at the age of twenty for the removal of a tumor of the shoulder.

On examination, the girl was found to be in apparently good general condition. The tumor of the thigh was roughly ovoid in shape, about four inches in its shortest diameter and six inches in its longer, which was parallel with Poupart's ligament. It was rather larger than a cocoanut, was in the main elastic, perhaps cystic in consistency, with here and there firmer masses. There was no pulsation, and no palpable lymph-nodes in the neighborhood. The skin was of a normal color and texture, and was not adherent. Very slight tenderness could be elicited on pressure over the median and lower portions of the growth. While the tumor could be moved about with some freedom, it seemed to be firmly attached in its deeper portion, probably by a pedicle or band to bone or periosteum. Had this been the case, a hip-joint amputation would hardly have promised a radical cure because of the extensive involvement of the soft parts.

On November 11, 1904, the tumor was aspirated, and bloody fluid withdrawn. Free incision then revealed that its contents were partly fluid and partly soft and encephaloid, while in the walls there was considerable bone in thin plates, making the diagnosis of osteosarcoma sufficiently probable to forbid further interference at that time. Accordingly, after a rough curettage, the partly collapsed tumor was packed and the incision sutured, with generous gauze drainage. The fluid evacuated from the cystic part of the tumor was submitted to Dr. A. Bookman, the physiological chemist, who reported as follows: "Blood did not clot on standing for two weeks. Thirty cubic centimetres gave 0.0148 gramme $CaSO_4$, equivalent to 0.375 per cent. $Ca(PO_4)_2$. This was about the normal calcium phosphate contents of the blood. The non-coagulability was therefore due to the presence of some substance destructive to the fibrinogen ferment, or to the lack of the ferment itself." A blood examination showed 7400 white cells, and demonstrated the absence of nucleated red cells.

The pathological department of the hospital reported that Dr. F. S. Mandlebaum had found the structure of a spindle-

celled sarcoma in the solid portion of the tumor, and that the bone plates showed nothing abnormal.

The patient reacted well after the operation, and the oozing, which was at first quite profuse, steadily diminished. A few days later, following the experience of Dr. Robert Abbe, a tube of radium of 300,000 activity was covered with a sterile finger-cot and inserted into the cavity of the tumor, and allowed to remain there for six hours. Suppuration, with slight elevation of temperature, followed, although there had been no infection before. Whether this suppuration was the direct result of radio-activity or of the possible introduction of some infective agent with the radium tube, it was impossible to say. The radium was employed in this manner at intervals of four to six days, and there was a rapid shrinkage of the tumor, until by January 1, 1905, it had been reduced to the size of a small adult fist, and had become so freely movable that its excision was determined upon. On January 6, in spite of the presence of suppuration, the tumor was dissected out. It was then seen that the growth had no connection with the femur, but had sprung from the quadriceps and the fascia lata. The extirpation was apparently thorough. Suppuration naturally followed, but with free drainage the case never assumed a threatening aspect, and recovery was now practically complete. The tumor was carefully examined after its removal, and the diagnosis of spindle-celled sarcoma confirmed. The neoplasm contained absolutely no bone.

Since the extirpation, Coley's fluid had been injected into the tissues near the cicatrix, the preparation used being that of Parke, Davis & Co. Seven injections, ranging from a quarter of a minim to nineteen minims, were given, and it was hoped that this treatment might prevent a recurrence. A reaction followed each injection.

This case, Dr. Lilienthal said, presented two interesting clinical points: First, as to the prognosis and operability, and, second, as to the error of diagnosis even after exploratory operation. The tumor at first seemed absolutely inoperable, excepting, perhaps, as a piece of surgical pyrotechnics, with resulting terrible mutilation of a young girl, and, even in the event of an operative recovery, the great probability of rapid recurrence. By the incision and drainage of the mass, together, perhaps, with the action of the Becquerel rays, shrinking to a point of easy oper-

ability occurred, and, even though there was still the possibility of metastasis and recurrence, the state of the patient was far better than it would have been with the major operation.

As to the second point, incision and careful exploration of a tumor within easy reach should yield a good anatomical and pathological diagnosis. Yet here, owing to the presence of the bone plates, he was led to believe that the femur must be involved. The final result, however, showed no connection with the bone nor with any structure near the bone. The neoplasm then must have been a true ossifying sarcoma.

## ANEURISM OF THE RIGHT SUBCLAVIAN ARTERY.

DR. LILIENTHAL presented a man, forty years old, who was admitted to Mt. Sinai Hospital on February 4, 1905. His family history was negative. He had had occasional attacks of rheumatism during the past ten years, and for the past year or two he had at times felt slight shooting pains in the præcordial region. He denied gonorrhœa and syphilis.

In December, 1904, the præcordial pain became more severe, radiating to the right shoulder and down the right arm. Shortly after this a swelling was noticed in the right supraclavicular region. The right hand, especially the finger-tips, became much swollen, with a sensation of pins and needles pricking it.

Upon examination, the supraclavicular mass proved to be about the size of a duck's egg, but globular in shape, and with an expansile pulsation. It was situated in the course of the second portion of the subclavian artery. A systolic thrill could be felt over the tumor. The overlying skin was normal and the clavicle was not involved.

On February 8, 1905, a ligation of the first portion of the right subclavian and the common carotid was done. An incision was made along the right clavicle, the skin-flap dissected upward and outward, the external jugular vein and all superficial vessels ligated, and the sternal origin of the sternocleidomastoid muscle divided. After freeing the clavicle, its inner half was resected. The first portion of the subclavian and the first part of the common carotid were exposed, their sheaths opened, and both were secured by temporary chromic gut ligatures. Upon tightening these ligatures, no pulsation could be felt in the aneurismal sac,

which was then opened by a transverse incision. The bleeding following this was very profuse, a jet of blood about four inches high spurting from it in a steady non-pulsating stream. The hæmorrhage was easily controlled by inserting a finger into the sac, and upon palpating the latter it was found that it had no opening on its cardiac aspect; but there was a very large one in its distal portion, proving that it was an aneurism of the sacculated variety. The finger was thereupon withdrawn from the sac, and the incision into it closed with chromic gut sutures. The two ligatures that had been temporarily placed on the common carotid and the first portion of the subclavian were then made permanent by the Ballance and Edward's method of tying, and the wound drained and closed.

The patient made a rapid and uneventful recovery, and no unfavorable symptoms followed the operation. Pulsation had never reappeared in the aneurism, which had now almost shrunken away. There was slight pulsation in the right temporal and carotid, but no pulsation in the right radial. The patient was kept in bed until March 2, twenty-two days after the operation, and was then allowed to sit in a wheeling-chair. He had gradually returned to walking, but no exertion of any kind had been permitted.

## EXCISION OF CARCINOMA OF THE ANAL PORTION OF THE RECTUM.

Dr. Benjamin T. Tilton presented a woman, forty-five years old, who had suffered for six years from piles and fissure. For five weeks before her admission to Bellevue Hospital she had suffered very severely from pain in the rectum, especially at defecation, constipation, and bloody stools. She had become considerably emaciated, largely owing to the intense pain.

Examination shqwed an ulcerating tumor, about the size of a silver dollar, on the posterior circumference of the rectum, in the vicinity of the sphincter. The glands in the groin were not enlarged.

Operation, September 29, 1904. This consisted in a posterior proctotomy and excision of the growth, with the surrounding adipose tissue. About one-third of the sphincter was sacrificed. The opening was allowed to fill in by granulation.

The functional result of the operation was excellent. In spite of the loss of the sphincter action, the patient could control her movements for five minutes, and, when not suffering from diarrhœa, the linen was not soiled. She had no pain, and now, at the end of six months, there were no signs of a recurrence. She had gained fifteen pounds, and was able to do her work as well as ever.

## CARCINOMA OF THE RECTUM.

Dr. John A. Hartwell presented a man, sixty years old (Case No. 7 of the series in his paper), who was admitted to Bellevue Hospital on July 4, 1904, with the following history: He had always enjoyed average good health, and gave no history of any chronic rectal trouble until about six months prior to admission. At that time he began to experience a rather severe knife-like pain at defecation, which often persisted for some hours. Shortly after this he noticed blood in the stools, and then put himself under treatment. The condition was diagnosed as hæmorrhoids, and he was sent to the hospital for an operation.

Examination at that time showed a markedly cachectic man, of small build, looking rather younger than his stated age. All his organs, excepting the rectum, were apparently normal. Rectal examination disclosed a rather friable mass nearly occluding the gut at a distance of an inch and a half from the anus. The inguinal glands were enlarged. A section from the growth proved by microscopical examination to be adenocarcinoma. A gland was removed for examination, and was declared to be non-malignant.

On July 9, 1904, inguinal colostomy was performed. A two-and-a-half-inch incision was made through the skin and external oblique, parallel to the fibres of the latter, at the level of the iliac spine, and just without the border of the left rectus. The internal muscles were opened in the direction of their fibres, and a knuckle of the sigmoid drawn up through the peritoneum, which was divided at right angles to the muscular incision. A point estimated as twelve inches from the anus was selected, and the gut here divided between two tape ligatures, protecting the wound by proper pads. The distal end was then fastened by the usual method in the lower angle of the wound. Next, a longitudinal incision was made in the linea alba at a level a little

above the first skin wound, dividing the skin and the anterior sheath of the rectus, which was here firm and resistant. The sheath was then raised from its muscle outward to the first incision, and the proximal gut end, protected by gauze, drawn between the two structures to the median wound, taking care not to damage the mesentery in this manipulation, but splitting it sufficiently to permit it to come through without tension. The open mouth of the gut was then fastened in the median skin and fascia wound, and the angle where it passed out of the peritoneum sutured to the membrane and the internal oblique muscle. The wound in the latter was then closed enough to gently constrict the angle and the distal end below, and the external oblique and the skin were then closed, excepting where the distal end emerged. A catheter was passed into the proximal end beyond its bend to allow the exit of gas. The wound was then carefully protected from later infection by gauze and collodion. The procedure required forty minutes, and was without shock.

The point, twelve inches from the anus, selected as the place for division of the gut allowed a sufficient length to the distal segment to cause no interference with the radical operation, and left a considerable pouch of the proximal sigmoid and colon to act as a fæcal reservoir. The wounds healed almost without suppuration. During the following four weeks the lower segment was irrigated through and through in order to cleanse it as far as possible.

August 9, 1904. The patient was placed in an exaggerated knee-chest position, and suspended from the lithotomy supports by a belly-band. An incision was made from the third sacral vertebra down to the scrotal angle in the perineum, encircling the anus, and, after clearing off the bones, the coccyx and two and a half sacral vertebræ were removed The anus was closed, and the dissection upward from the point of the rectum was begun. A sound in the urethra facilitated its separation from the urethra and prostate. The peritoneum was opened when reached, and the rectum drawn down with its surrounding areolar tissue and freed on all sides for a distance of eight inches up, the vessels being clamped and tied as they were reached. The gut was then divided between two tape ligatures with the actual cautery, and the upper end closed with catgut sutures. The peritoneum was then sutured around the stump, and the stump fast-

ened in the depth of the wound after placing the patient in the prone position. This forced all these structures back, so as to make them easily accessible. The greater part of the wound was closed with tier sutures, and a gauze drain packed over the remaining raw surfaces and brought out through the perineal end of the wound.

The knee-chest position gave a perfect exposure of the parts, and lessened the bleeding to a remarkable extent, so that the dissection was almost an anatomical one. The change to the prone position facilitated the final steps markedly. A small hole torn in the gut at the site of the growth was immediately sutured, and no contamination resulted.

The fastening of the blind stump infraperitoneally guarded against peritonitis in case of leakage. The second operation occupied one hour. The patient was placed in bed in the dorsal position to facilitate drainage. Primary union was obtained in the whole line of sutures, and the drained cavity practically closed in four weeks. The patient was out of bed in seventeen days, and discharged on August 30, twenty-five days after operation. By that time he began to have considerable control over the inguinal anus. This control had steadily increased, and now, eight and a half months after operation, he was in excellent condition, knew when the bowels should move, and was able to keep back the movement for some time. There was usually only one movement a day, and he expressed himself as satisfied with his condition. There was no evidence of a recurrence.

Dr. John A. Hartwell presented also a woman (No. 46 of the series in his paper), twenty-six years old, who was admitted to the Lincoln Hospital on March 18, 1904. Her family history was negative. During a pregnancy in 1900 she developed hæmorrhoids, which bled from time to time, the bleeding gradually becoming more severe. They were further aggravated by a second pregnancy in 1902, and from that time on she suffered almost continuously from bleeding and pain in the rectum. She continued to lose weight and strength, and at the time of her third delivery, in February, 1904, she was so emaciated that she lacked the strength necessary to reinforce the pains, and after being five days in labor she was delivered with forceps in a hospital. This resulted in a complete tear of the perineum and vagina through into the rectum for a distance of two and a half inches.

When she was admitted to the Lincoln Hospital she was markedly anæmic and emaciated, and so weak as to be unable to sit up in bed. The rupture of the perineum into the rectum during her recent pregnancy had left a large granulating wound. Incontinence was complete, and the vagina was filled with fæces and pus. The bladder was infected, the urine showing a heavy precipitate of pus. All the parts were exquisitely tender and her suffering was intense.

About a month was consumed in an attempt to get the parts clean preparatory to repairing the perineum. This failed, however, owing to the constant fouling with fæces and her poor resistance to infection. During this time she began to show symptoms of intestinal obstruction, despite the constant diarrhœal discharge through the perineum. An examination under ether showed a constricting mass in the rectum, about two inches from the anal aperture, through which the tear into the vagina passed. A colostomy was at once performed by the method of spur formation, a glass rod passing through the mesentery underneath a knuckle of gut, which was opened on the following day.

Following this, the rectal and vaginal condition, as well as her general health, rapidly improved, so that on May 1 she was considered well enough for the radical removal of the rectal growth, which a pathological examination had shown to be carcinomatous.

Operation, May 1, 1904. With the patient in the exaggerated knee-chest position, an incision was made from the third sacral vertebra forward, encircling the torn anus and perineum well up to the vaginal sides. The coccyx and two and one-half sacral segments were removed. The rectum was then freed at the anal margin, and its dissection upward was completed for about six inches. The entire posterior vaginal wall, up to the cervix uteri, was included in the freed mass. The rectum was then amputated, the stump dragged down, and the peritoneum sutured around it, and this end was then fastened deep in the wound to prevent its retraction into the peritoneal cavity. The cloacal opening was partly closed with sutures and partly packed. The bleeding was exceedingly scant, owing, it was believed, to the knee-chest position. This latter was easily secured by suspending the patient, abdomen down, from the usual lithotomy supports,

her knees resting on a large sand bag and the thighs being bound to the supports.

There was comparatively little shock, considering the extent of the operation, and the poor condition of the patient at the time. Convalescence was tedious, the wound being badly infected, and her general condition being one of chronic sepsis. The wound, however, gradually closed, the vagina and sacral cavity being continuous. She gradually gained in weight and strength, and left the hospital June 26, 1904, three months after admission.

At the present time, eleven months after operation, the patient is engaged as a house-worker and is enjoying good health. The colostomy wound, which had prolapsed to a moderate degree, gave sufficient control to keep her clean, and in no way interfered with her work. The posterior wound was still open at the sacral end, and the cervix uteri pouched through at this point. There was, however, no discharge to speak of, and the condition was not more than an annoyance. The cystitis had responded to treatment and was cured. Since the patient's discharge from the hospital, she had increased in weight from 85 to 125 pounds.

Dr. Hartwell showed one other case (No. 45, the latter a patient of Dr. Adrian Lambert) in addition to the above, illustrating the method of radical treatment of cancer of the rectum, with particular reference to the inguinal colostomy as performed by him and described in the paper. He also showed a case of syphilitic stricture of the rectum on which an artificial anus had been done by the method described in the paper of the evening. These cases illustrated well the possibility of obtaining a very satisfactory control over the bowels through such an anus, as all of them were attending to their former duties, with no inconvenience from the deformity.

## THE RADICAL TREATMENT OF CANCER OF THE RECTUM, WITH PARTICULAR REFERENCE TO THE INGUINAL COLOSTOMY.

Dr. John A. Hartwell read a paper with the above title, for which see Annals of Surgery for September.

Dr. Tilton said he did not think Dr. Hartwell had given

quite enough credit to the treatment of these cases by excision and establishment of a sacral anus. He had observed several cases in which that procedure had been followed by extremely good functional results. He recalled one case, that of a woman, who was kept under observation for a year after the operation. She had absolutely no trouble with the movements of the bowels, and was apparently much better off than she would have been with a colostomy wound. The moral effect was less disagreeable. While Dr. Hartwell's method of operating in these cases may be less dangerous than other methods, as far as the immediate mortality was concerned, it had not yet been demonstrated by experience that there was less risk of a recurrence.

Dr. John B. Walker said that in those cases of cancer of the rectum in which the growth was located within two or three inches from the anus the establishment of a sacral outlet for the fæces would prove satisfactory. However, in the larger number of cases the growth is situated from four to seven inches from the anus, and in these cases the entire lower segment of the bowel should be removed. This will necessitate an inguinal anus, which should be made early before any symptoms of obstruction arise. Patients who are personally clean and careful learn to control the movements of the bowels and keep the skin adjacent to the anus quite free from irritation.

Dr. George Woolsey said he had always favored a preliminary colostomy in these cases, partly on the ground suggested by Dr. Hartwell, namely, the exclusion of sepsis. Another reason for favoring this preliminary operation was that the hand could be introduced through the inguinal wound to determine the extent of the new growth and of the lymphatic involvement which would help to settle the question as between a radical and a palliative operation. In a case that he had operated on by this method three and a half years ago, the patient was still alive and in good condition. The speaker said he did not agree with the statement made that in so large a proportion of these cases the anal segment had to be sacrificed, and he recalled two cases in which he was able to retain it. In those cases where this segment of the gut had to be sacrificed, he thought the establishment of an inguinal colostomy was preferable to a sacral anus. The former was more accessible, could be more easily cleansed and kept continent.

DR. HARTWELL, in closing, said that a complete colostomy had only been done in four or five of the forty-six cases he had recorded, while a lateral colostomy, for the purpose of relieving obstruction, had been done ten or eleven times. The speaker said he did not claim that the method of treating these cases by establishing a sacral anus did not in a few cases give good control over the fæces, but that it was not sufficiently radical, as by that method 50 to 65 per cent. of surviving cases recurred, not more than from 15 to 25 per cent. being cured. The formation of an inguinal colostomy wound and the removal of the entire lower segment of the bowel were the most radical methods of treating these cases: it did away with the irritation caused by the passage of fæces through the lower gut, which was a more important factor than saving the sacral segment.

## ENDOTHELIOMA OF THE CAUDA EQUINA; EXCISION.

DR. CHARLES N. DOWD presented a specimen obtained from a young man of eighteen years who was injured about seven years ago while coasting, a boy jumping on his back. Four years later he was brought to St. Mary's Hospital complaining of pain at the lower end of the spine which had been persistent for more than a year, and, as the coccyx was broken and lay forward at a right angle with the sacrum, and was tender, it was removed. At that time there were no distinct sensory disturbances, but the Kernig symptom was present, and he had marked rigidity of the back, with lumbar lordosis.

In January, 1904, his back was still very rigid; there were lumbar lordosis and compensating dorsal kyphosis. He could not bend his back so as to touch the floor, but bent the knees for that purpose, and held the back rigid. The patellar, cremasteric, diaphragmatic, and ocular reflexes were normal. There was no clonus. Sensation was normal. There was tenderness on pressure over the lower lumbar spine. He suffered from so much pain at night that he was rapidly acquiring the morphine habit.

In June, 1904, his symptoms had increased, and his pain was uncontrollable from two to five or six o'clock every morning. This pain was definitely located down the back of the thighs and calves, and on the left side, back of the inner malleolus, to the plantar surface of the foot. On the right side it did not go below

the calf. This distribution corresponded exactly to the diagram in Dr. M. Allen Starr's recent book for a lesion at the first sacral vertebra. There was considerable atrophy of the thighs, particularly of the left, with fibrillary movements in the gluteal region. There was much tenderness over the upper sacral region, and a marked gluteal reflex on pressure at that point. There seemed to be slightly diminished sensation along the painful area, but this could not be definitely made out.

An operation was advised by Dr. Pearce Bailey, and was performed by Dr. Dowd at the General Memorial Hospital on June 4, 1904. The opening was made at the site of the first sacral vertebra, a portion of the lamina of the last dorsal being removed. A tumor was found within the dura; it had irregular white spots on its cortex, and in appearance closely resembled a tubercular lymph-node. Fearing that this was a glioma, and that the fibres of the cauda were so incorporated in it that paralysis of the sphincters would follow its removal, he cut away a portion of the tumor for examination, and, feeling that pressure-relief would result from the opening in the spinal canal, he awaited the pathological report before further operation. The patient recovered promptly. His symptoms were very much relieved, and he passed several fairly comfortable months. The pathological report was given with reserve, fibroma being the most probable diagnosis.

In February, 1905, the patient again began to complain of his night pains, and on March 1 Dr. Dowd removed the tumor of the spine. The laminæ and spinous processes of the fifth lumbar vertebra, most of those of the fourth, and part of the spinous process of the third were removed. The posterior portion of the canal, corresponding to the first and part of the second sacral, was also removed. The tumor was about two inches long and one inch in diameter, and was adherent to the dura. There were a few spots of glistening white color below, but its general appearance had changed considerably since the first operation. There was a slight leakage of cerebrospinal fluid for the first few days, and the patient had to be catheterized until the fifth day, when he voided his urine normally. His pain had ceased, but he had a slight burning sensation in the right leg. The pathological examination showed that the tumor was an endothelioma, probably arising from the lymph spaces of the pia mater.

The symptoms which this tumor gave rise to were very definite, and corresponded to the classical description of a slowly increasing pressure in the region of the last lumbar and first dorsal vertebræ. In many respects, however, the case was an unusual one. Schlesinger tabulated 400 tumors of the spinal cord, 302 of which were intradural. In the entire list there were only six cases of endothelioma; sarcomata were much the most common type—118 in all. In a list of 264 tumors of the spinal cord, he found that 35 ($13^2/_{10}$ per cent.) were sacral, or of the cauda equina. Of course, the prognosis in these tumors was far better than in those that were situated higher up in the spinal canal. In the case shown by Dr. Dowd, the prognosis depended entirely on the character of the growth, since the patient was now free from pain, had possession of all his faculties, and expected to begin work soon. So few of these tumors had been reported, that pathologists were much at variance in giving their diagnosis and prognosis. The relationship between trauma and the development of these tumors was interesting. Starr and Schlesinger both indicated a belief that traumatism might be an important element. The history of trauma in this case was very definite. indeed.

Dr. Woolsey said that within the past two years he had seen two cases of endothelial tumor of the spinal cord, one intra- and the other extra-dural. In neither case was there recurrence so far.

# TRANSACTIONS

OF THE

# PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, April 3, 1905.*

The President, HENRY R. WHARTON, M.D., in the Chair.

## SCREW FIXATION IN CASES OF INTRACAPSULAR FRACTURE OF FEMUR.

DR. GWILYM G. DAVIS presented a man, forty-seven years of age, who, one year before, had fallen a distance of eight feet, striking on his right hip. The femur on the injured side had been fractured once before, when he was fourteen years old.

On examination, the right lower extremity was found to be shortened about 2.5 centimetres (1 inch). Pain on movement of the hip was very severe. The foot was everted, the fascia lata lax, and the greater trochanter moved with rotation of the leg. It was found to lie above Nélaton's line, and the base of Bryant's triangle on the injured side was shorter than that of the sound side. In short, there were present all the classical signs of a fracture of the neck of the femur. A skiagraph showed a line of fracture beginning above high up on the neck near the articular cartilage and running down almost vertically. The outer fragment was pushed up and was above the inner fragment.

On the sixth day after the injury an incision about 7.5 centimetres (3 inches) long was made over the greater trochanter, and an ordinary steel wood screw 7.5 centimetres (3 inches) long inserted up through the trochanter and neck into the detached head, traction in the meantime being made by an assistant. A plaster-of-Paris dressing was then applied, embracing the pelvis and down to the knee, and later the leg was placed on a sliding foot-piece to keep the foot from everting. The wound healed

without trouble, but a sinus formed later at the site of the screw, and it was removed after having been in eight weeks. Two or three weeks later the patient was discharged, and now, a year after, he has apparently bony, or at least firm, union, very little shortening, almost normal movements, a slight loss of abduction, and walks comfortably without any support, and only a slight limp due to the uncorrected small amount of shortening.

Dr. Davis further remarked that the results obtained by the various methods of treatment of fractures of the neck of the femur in those other than children and the aged are as yet so unknown that it is impossible to say which is best. That the methods usually pursued and the results obtained by the mass of the profession are unsatisfactory is evident from the frequency with which ununited fractures of this part are seen. In children, conservative treatment by splints and apparatus has been demonstrated to be efficient. In the aged, say, those over sixty years, bad results are accepted with a certain amount of resignation; but when an otherwise healthy man, from twenty to fifty odd years of age, is left with an ununited fracture of the neck of the femur, the distress and disability are so marked as to justify radical measures in order to avoid it. Many of these patients have more or less pain, a marked hobbling gait, and are often compelled to use a support, such as a cane or crutch. They are debarred from all active occupations, and perhaps relegated to the ranks of useless cripples. The most usual way of treating the injury is probably by weight extension, the same as if the fracture was lower down. The uselessness of this method is seen from the resulting ununited fractures. Of the value of other methods we have as yet too little data to judge. The treatment of this fracture in the aged by the method of combined weight extension and lateral traction has in his hands been far more satisfactory than by weight extension alone. The method of placing the limb in an abducted position in plaster-of-Paris is likewise better than using weight extension alone. He had recently had one good result from this method, but, to offset this, he recently saw a case in which the method had been equally faithfully applied without union occurring.

Having previously operated on several cases of ununited fracture, he decided to apply a modified form of the same method to recent fractures of the neck of the femur, and the good result

obtained in the case shown had encouraged him to resort to the same plan in future cases.

Dr. W. W. Keen briefly detailed a case in which he had employed a device similar to that of Dr. Davis. The lesion differed, however, in being an old, ununited fracture which required an anterior incision to freshen the bone in addition to the lateral one for inserting the screw. The patient can now walk without the aid of crutches or a cane. Two screws were employed to unite the fragments in this instance, and they are still *in situ* after more than a year. The case will be reported in full later.

Dr. Robert G. Le Conte said that the proposition advanced by Dr. Davis, of immediate operation in intercapsular fracture of the thigh, was a very broad one. In these days of modern asepsis the ideal treatment of fracture of the femur is perhaps the open method, whether the break is intercapsular or of the upper portion of the shaft; and yet no one is quite bold enough to carry out this method in every case. In Dr. Le Conte's experience in patients whose ages range from forty years to extreme old age, the non-operative methods of treatment in intracapsular fractures result in giving useful and valuable legs in perhaps 80 per cent. of the cases; in about 20 per cent. this favorable result is not obtained. These statistics are not exact and are given from memory only. Granting that good results are obtained without operation in four out of five cases, why should we not continue the expectant method of treatment as opposed to the operative. If union fails to occur, operation can be later performed with little, if any, radical risk. It should be remembered that some of the cases of useless limbs following the expectant or non-operative treatment are due to osteophytes forming about the seat of the fracture and mechanically interfering with the motion of the joint, and not to ununited fractures. Dr. Le Conte would be very loath to indorse the statement of Dr. Davis that the majority of recent intercapsular fractures of the femur should be treated by the open method.

Dr. John B. Roberts did not believe the ideal method of treating fractures of the femur is by incision; in certain cases only is it advisable. In fact, the ideal method is treatment without incision, especially in fractures of the shaft. Unless the break is in the upper third, we expect good results from treatment by traction, elevation of the bed to secure counter-traction,

and lateral support. He approaches such cases with utmost confidence that good results will follow this treatment, and in but few cases is there disappointment. Contrary to Dr. Le Conte, he would not call this expectant treatment. In the case of fracture of the neck of the femur we are not always sure that it is intracapsular; in the case exhibited, the skiagraph seems to indicate that it is partly outside the capsule, which is often the true condition present. In Dr. Roberts's experience, in a man of the age of Dr. Davis's patient with a fracture not entirely intracapsular, good results may be expected from treatment by weights, countertraction, and lateral support. This he would not call the expectant, but the non-operative method of treatment. It is interesting to hear Dr. Davis speak of the sinus following the use of the screw, as that has been Dr. Roberts's experience with the use of nails. Suppuration nearly always occurs, and there is delay in closure of the sinus after the nail is withdrawn. Dr. Roberts has been surprised to find good results without operation in a few patients seventy or eighty years of age, with what were at least supposed to be intracapsular fractures. When the fracture lines are apparently through the base of the neck outside of the capsule, a good leg should be expected without operation.

Dr. Davis, in closing, said that an interesting point in these cases is the correctness of the diagnosis; it is often difficult to demonstrate whether the break is intra- or extracapsular. Anteriorly, the capsule extends downward to the anterior intertrochanteric line, and nearly every fracture is bound to be intracapsular at this point. Posteriorly, the capsule extends half-way to the intertrochanteric line, and in some instances even more. Hence many fractures are partly intra- and partly extracapsular. It is not possible to make a differential diagnosis with any degree of certainty. He supposes that Dr. Le Conte's statements refer to fractures of the neck alone, as it is well known that extracapsular fractures involving the trochanters unite readily and with an abundance of callus. As to fractures of the neck they are not so satisfactory. If Dr. Le Conte's figures embrace all the fractures of the aged, 80 per cent. of good results is a trifle high; he is not willing to admit this. Dr. Roberts' statements regarding the good results in fractures partly intra- and partly extracapsular are not capable of verification; as such diagnosis cannot be made, the absolute condition is unknown. As to the results of intra-

capsular fractures, it was held years ago that they almost never unite by bony union. When they are partly intracapsular and partly extracapsular, good results might be expected in young adults. Notwithstanding this, the experience of Dr. Davis is that results in general are bad in fractures of the neck of the femur in young and middle-aged adults; this opinion is based on eight or ten cases seen during the past four years, all in individuals between twenty-five and fifty years of age. Ununited fractures during this period are not uncommon. Dr. Davis does not advise operative treatment in children nor in the aged. In the latter class, reparative efforts are slight; in children, conservative methods give good results. In certain other cases, as in the patient exhibited, disability from failure of conservative treatment is so great, and the occurrence of this result so frequent, that a more positive method of treatment is desirable. Dr. Davis does not, however, positively advise open operation in all cases, but would not hesitate to employ it in comparatively young adults, under sixty, otherwise healthy, who have intracapsular fracture. For treating these fractures there are now recognized two methods that are still largely untried. They are, 1, placing the thigh in abduction, and, 2, applying longitudinal traction and lateral traction combined. The use of these methods has as yet not been so extensively reported as to determine their true value. As a competitor of the two, to be tried out with them, Dr. Davis adds a third, the open incision and insertion of a screw as detailed in the reported case. The operation is simple, being little more than a straight incision with insertion of the screw while extension is made. Healing always readily occurs. When the screw loosens, an inflammatory focus forms beneath the scar and this tissue soon gives way, producing a sinus through which the screw may be removed. Operation does not appreciably add to the danger of the treatment and gives improved results.

## ANTHRAX.

Drs. G. J. Schwartz and B. Franklin Royer presented, jointly, a man, aged twenty-four years; white; single; occupation, farmer, who was admitted to the Jefferson College Hospital, in the service of Dr. W. W. Keen, February 21, 1905, suffering from anthrax, and with the following history:

The farm on which he labored was situated at the head of a small stream, along the borders of which a number of cases of bovine anthrax occurred in 1899. Some of them were in the immediate vicinity of the farm. Since then this meadow land has been "out of the tide," so that it has been impossible to pasture cattle or cut hay. The farm being at the head of this stream has made the meadows drier and admitted of some pasturage, and last season considerable rough hay was cut upon it. Unknown to the health authorities, two apparently healthy mules belonging to the patient's father became suddenly sick, and died within two days of each other. The supposition was then that they were poisoned. Their carcasses were buried in this field. Later in the season, a crop of hay was harvested from the field. This hay comprised a portion of the fodder of the stock farm.

On February 12, 1905, two apparently healthy cows, which had been eating the hay harvested from the above mentioned field, were turned out in the morning and died during the day. The patient skinned the last cow which died and sold the hide to a dealer, who expressed it to this city. The patient noticed while skinning the cow that a bloody serum exuded from several sores on the hind quarters of the cow.

On February 14, 1905, two days later, the patient noticed a small red spot, which resembled a flea-bite, situated about one inch above the left wrist-joint on the posterior external surface on a line passing through the first metacarpal bone. The next day two papules appeared on flexor surface of the same wrist. These papules gradually became larger and were accompanied by slight itching and burning. During the next day a small blister containing a yellow serum streaked with blood and surrounded by an inflammatory band, œdematous, with overlying skin of livid hue, appeared.

On February 18, six days after skinning the cow and four days after the lesion appeared, the patient complained of slight headache and cough; by this time œdema had involved the hand, wrist, and was rapidly extending up the forearm; blisters had become blebs, were tense, and contained a distinctly blood-tinged, yellowish serum.

The following day, February 19, he became alarmed about his condition and went to bed. The headache became very severe. Cough became productive, pain in arm throbbing, swelling ex-

tended rapidly to the arm. Now, for the first time, the patient sent for his family physician. Local applications were made. During the night the patient was restless, could not sleep, and felt much weaker.

On February 20, condition was much worse, and his physician decided to send him to the Jefferson Hospital, where he arrived February 21.

His condition on arrival was as follows: Facial expression was that of a person suffering considerable pain and mental anxiety; face was flushed, and there was slight sweating about the forehead; pupils dilated, tongue slightly coated and dry, slight nausea with no vomiting; temperature, 100.4° F.; pulse, 82, soft, compressible; respiration, 24. A brief physical examination of chest showed heart and lungs apparently normal with the exception of a few râles posteriorly on both sides. The left hand, forearm, and arm to within 10 centimetres of the shoulder-joint were immensely swollen. The swelling pitted on pressure, and there was an entire absence of emphysematous crackling. The overlying skin was of a slightly dusky red color, and pressure caused the redness to slowly disappear, but it returned slowly when pressure was removed. The axillary lymph glands were not palpably enlarged, but on palpation the spleen seemed to be enlarged. Situated along the forearm on the flexor surface were several medium-sized blisters containing a cloudy, yellowish serum, and just above the wrist-joint over the line of the artery was a large bleb the size of a half-dollar, filled with blood-stained serum.

Smear preparations, cultures, and a blood examination for the anthrax bacillus made, and within one hour's time a verbal bacteriological report confirmed the clinical diagnosis.

The report, from a later more exhaustive examination, was that the bacilli obtained in spreads from the blebs of the left forearm possessed the morphological and tinctorial characters of the Bacillus anthracis. In cultures, a bacillus, possessing the morphology, tinctorial, and biological characters of the Bacillus anthracis in pure culture. The blood taken from the right arm developed no growth, indicating in all probability that the infection at the time of examination was local in nature.

The following treatment was carried out: The patient was etherized and five drachms of a 3 per cent. solution of carbolic

acid was injected into the skin and superficial fascia, so it would completely encircle the arm one and one-half inches above the infiltrated tissues. The bullæ over wrist and back of forearm and a ring of healthy tissue around each of these were excised down to the deep fascia. The infection did not seem to go below the deep fascia except over the radial artery just above the wrist. This suspicious tissue was removed, and in doing so the radial artery was wounded. After tying both ends of the artery, several syringefuls of a 3 per cent. solution of carbolic acid were deeply injected into the tissues around the areas removed. After this was completed, long multiple longitudinal incisions were made into the œdematous tissues, allowing a large quantity of clear yellow serum to exude.

The tissues, on incision, presented a yellowish color, gelatinous and very friable. At no point was any pus found. The limb was then wrapped in hot antiseptic fomentations, placed on a pillow, and surrounded by hot-water bags.

At the end of the operation the patient was severely shocked and intravenous infusion of salt solution was then given by Dr. Anderson.

The patient received free stimulation-strychnia and atropine, and every three hours, while he remained in the hospital, received a hypodermic injection of 30 minims of 3 per cent. carbolic acid.

The patient was transferred to the Municipal Hospital the following morning after the operation. His condition on removal was fair.

On February 23, 1905, was received a report from the State Board of Veterinary Medical Examiners, stating that the body of the cow skinned by the patient showed lesions of anthrax.

Dr. Schwartz said that most authorities advise excision[1] of the malignant pustule and cauterization with pure carbolic acid.[2] Tillmans, of Leipsic, holds that anthrax remains local longer in man than in animals; hence, excision and cauterization should be employed in human anthrax. He excises the area of infection, going well into healthy tissues, and cauterizes it, then injects in and about it a 1 to 1000 solution of bichloride of mercury and a 5 per cent. solution of carbolic acid. By this treatment,[3] Lenoyel and Koranyi lost but thirteen cases out of 142. Müller,[4] in opposition to the above treatment, says that it is impossible to destroy the disease by excision of the seat of inoculation. In

guinea-pigs, amputation of a limb performed a few hours after inoculation fails to prevent the disease. His belief is that treatment should aim to make the cells about the inoculated area prevent dissemination of the bacteria and protect the body. The products are injurious, if absorbed, but they also tend to destroy the bacteria, hence excision is harmful.

Müller's treatment is as follows: Immobilize the parts, and elevate, if an extremity, apply mercurial ointment and give alcohol internally in large doses. He describes thirteen cases successfully treated by the above method. Notwithstanding the above, the majority of reports lean towards excision with cauterization of the infected area.

Cauterization with cautery, pure carbolic acid, caustic potash, hydrochloric acid, acid nitrate of mercury, and, in fact, every caustic substance known, has been either tried or suggested.

*Medical Treatment.*—Muskett [5] notes the treatment of fifty cases by simple applications of ipecac to the area of infection without excision, and without a fatal result in any case.

Laboratory experiments have shown that powdered ipecac will destroy the anthrax bacillus, but has no effect on the spores, and in the body sporulation does not take place.

Injection Method: Scharnowski [6] reports the treatment of fifty cases by carbolic acid injections, with a mortality of 2 per cent.

Graef [7] reports the treatment of 384 cases by cauterization with caustic potash, with a mortality of 5 per cent.

The treatment by caustics is, however, very painful, and, after all, it seems impossible to say which treatment is best for all cases, for each individual case must necessarily be considered as standing absolutely alone.

Dr. B. F. Royer stated that on admission of the man to the Municipal Hospital, smears made from scrapings from the floor of the extirpated areas, and smears of blood made from a finger prick, failed to show anthrax organisms. The blood count at this time showed: Leucocytes, 19,400; erythrocytes, 3,210,000.

Hæmoglobin not estimated.

Differential count (600 cells count); polynuclear leucocytes, 87.68; large lymphocytes, 7.66; small lymphocytes, 2.66; eosinophiles, 2.00.

*Urine Analysis.*—Chemical Examination. Amber, acid,

1012, no sugar, albumen.? Microscopic Examination. Leucocytes. Numerous hyaline, epithelial, and granular casts. Urine centrifuged, and the sediment examined for anthrax organisms with negative result.

Smears and cultures made at this time from the nasal secretions from the saliva and from the fæces failed to show anthrax germs.

Second day after admission, tenth day of the disease, physical condition improved; pleuritic pain less marked; pulse of better volume; temperature normal; urine loaded with hyaline and granular casts.

Eleventh day of disease, third after operation, abdominal distress and frequent desire for stool suggests mercurial poisoning. Salt solution substituted for the arm. Blood culture made second day after admission negative.

From this time on nothing of very great interest resulted. Leucocyte count, sixth day after admission, fourteenth day of disease, is 20,400. Erythrocyte count, 3,400,000. Urine still filled with hyaline and epithelial casts. Anæmia probably due to nephritis. For the next few days the kidneys were somewhat erratic, 111 ounces being voided on the seventh day after operation and 128 ounces the ninth day after operation. General condition seems to be good.

Blood culture made nine days ago still showed no growth.

From this time until the forty-fourth day of his disease nothing worthy of special consideration occurred. He was detained at the Municipal Hospital thirty-five days, while the wounds from operation were healing. On being discharged, he returned to Professor Keen's clinic, where he was shown to the students.

Dr. Royer remarked, further, that the most marked advance in the treatment of anthrax has been made in Italy. In America, where the disease but infrequently occurs, we are apt to lose interest in the disease, or we may fail to keep in touch with the most recent advances in its treatment. This disease has long been considered a surgical affection. The day seems to have dawned, however, when a more scientific treatment is available. This newer method of serum treatment was introduced by Professor A. Sclavo, of the University of Siena, in 1897. The underlying principle with this therapy, and in fact with nearly all serum

therapy, is to get from a susceptible animal the substance manufactured by that animal in acquiring a tolerance to many times its fatal dose of toxin.

Sclavo's [8] method of producing this serum is based on vaccination and upon immunization by toxin injection. He first vaccinates an ass with an attenuated anthrax culture, and in ten or twelve days with a more virulent culture. So far, then, the process is like vaccination in principle. The object is to protect against a dangerous disease by deliberately inoculating with a harmless disease. This is the method practised by veterinarians in immunizing herds. The next steps are to use virulent cultures of anthrax in increasing quantities until enormous doses can be tolerated. This is comparable to the process in making diphtheria antitoxin, but differs from it as follows: In inoculating horses, to make antidiphtheritic serum the toxin only is used. This germ can readily be separated from its toxin. Not so, however, with anthrax. Here we have an intracellular toxin. (At least it appears to be intracellular in artificial media.) For this reason it is necessary to inject the entire culture. The process and results, however, are very similar to that of making diphtheria antitoxin. After a period of several months of such treatment, the ass is bled, and the serum separated from clot is preserved by adding ether to the extent of 3 per cent. of its bulk. The serum is now tested on rabbits by first inoculating a series for controls and an equal number for treatment with 5 cubic centimetres of a suspension of a culture of anthrax grown on agar for two days. The test rabbits are given at the same time 10 cubic centimetres of the prepared serum, usually by injection in an auricular vein. This testing, you see, is similar to the test for diphtheria antitoxin. If the controls all die and the treated ones are all protected, the serum is regarded as high grade. As yet, Sclavo seems to have no method of standardizing as we have in the production of diphtheria antitoxin.

Sclavo's [8] present contentions are as follows: (1) The serum is innocuous even in large doses; (2) it can be well borne, even when introduced into the veins; (3) no case taken in an early stage and of moderate severity will be fatal if treated with the serum; (4) by its means some cases may be saved when the condition is most critical (he narrates one case in which a woman recovered after bacilli were found both in the blood and urine,

and another in which they were present in the urine); (5) when injected into the veins it quickly arrests the extension of the œdematous process, so as to reduce notably the danger of suffocation which is present in many cases when the pustule is situated on the face or neck; (6) if used early enough, it reduces to a minimum destruction of the tissues when the pustule is localized, and thus diminishes risk of deformity; (7) persons attacked appear to become convalescent almost at once. The dose of serum recommended in ordinary cases is 30 to 40 cubic centimetres subdivided into three or four injections, subcutaneously into different parts of the abdomen, and followed in twenty-four hours, if there has been no improvement, by further injection of 20 to 30 cubic centimetres. In very grave cases he recommends intravenous injection, preferably into one of the superficial veins on the back of the hand, of 10 cubic centimetres, followed in an hour or two, where no improvement is shown, by another similar dose.

Bandi [9] reports two cures. In one cauterization had failed. There was œdema of the entire arm, the glands in the axilla were as large as a hen's egg. Fever, 104° F.; pulse rapid and intermittent and patient in coma. Anthrax organisms were found in blebs surrounding the cauterized areas and in the blood by culture. In this case 150 cubic centimetres of a serum, prepared by using a sheep and Sclavo's methods, were given intravenously, and followed later on the same day by 50 cubic centimetres intravenously.

In his second case, with temperature 103° F., rapid, irregular pulse, swelling and œdema of the arm, and with a positive blood culture, cauterization, and 80 cubic centimetres intravenously and later 30 cubic centimetres subcutaneously, promptly cured the patient.

Recently, Lockwood [10] and Andrews treated a case of malignant pustule of the cheek with 40 cubic centimetres. Sclavo's serum injected subcutaneously. No other treatment was given; the œdema increased, the enlarged glands subsided. Recovery most satisfactory.

Bowlby and Andrews [11] report a case of malignant pustule of the forehead treated with Sclavo's serum and recovery. In this case the glands at the angle of the jaw were much swollen. They rapidly subsided. The œdema extended for a time after treatment was begun. Recovery was satisfactory in every particular. No other treatment was given.

Legge [12] has studied a series of cases treated by Sclavo and others in Italy, and those treated in England since July, 1904. His study, reported in his Milroy Lecture, would encourage one to recommend anti-anthrax serum as almost a specific against this dreaded disease if given early. If given late, it may be necessary to practise excision or free drainage in addition to serum therapy.

From the data presented by Legge, Bandi, Soberheim, and Sclavo it would appear that the time had come when we in this country should have a supply of anti-anthrax serum kept by health boards or research laboratories where it might be gotten in a few hours by those called upon to treat anthrax.

When this case was sent to the Municipal Hospital, he communicated with Parke, Davis & Co., H. K. Mulford & Co., the Marine Hospital Laboratory, and through Dr. Cairns, of our health office, with the Bureau of Health of New York, but could find no serum in this country. This patient's treatment consisted of stimulation with whiskey, strychnine, and quinine, carefully looking after the emunctories and diet, and flushing him with large quantities of water. When evidence of mercurialism developed, the bichloride dressing was omitted. Salt solution was used for twenty-four hours, and then potassium permanganate, 1 to 5000, as a wet dressing. Later, a 1 to 8000 bichloride dressing was used until the arm was nearly healed. Where the indurated areas were dissected out, curettement was required, and, later, stimulation with silver nitrate brought granulations to the surface.*

---

* BIBLIOGRAPHY.

[1] Carter. Medical Journal Quarterly, Sheffield, 1904.
[2] Tillmans. System of Surgery.
[3] Lenoyel and Koranyi. Quenan System of Surgery.
[4] Müller. Deutsche med. Woch., xx, p. 515, 1895.
[5] Muskett. Lancet, 1888, vol. i, p. 269.
[6] Scharnowski. Reference, Milroy Lectures, British Medical Journal, March 18, 1905.
[7] Graef. Wien. klin. Rund., x, p. 165, 1903.
[8] Sclavo. Rivista d'Igiene e di Sanita Pubblica, xiv, 1903.
[9] Bandi. Lancet, August 6, 1904, p. 372.
[10] Lockwood and Andrews. British Medical Journal, January 7, 1905.
[11] Bowlby and Andrews. British Medical Journal, February 11, 1905.
[12] Legge. (The Milroy Lectures), British Medical Journal, March 11, 19, 25, 1905.
Legge. British Medical Journal, July 16, 1904.

Dr. W. W. Keen said that when the resident physician notified him by telephone of the patient's admission, he at once suspected some animal disease, as anthrax or actinomycosis, and directed that a bacteriological diagnosis should be made at once. The subsequent history shows that we now possess a thorough means of prompt diagnosis, as within one hour the examination had been made and anthrax bacilli found. Dr. Keen saw the man one and one-half hours after admission. A slight pimple had been present on the wrist, but no pustule. The most conspicuous features were a number of large blebs and an enormous œdema of the arm. At the deltoid insertion the arm was fully one and one-half times as large as immediately above that point. The case then was one of anthrax œdema. The communicability of the disease to others demands attention. This patient was isolated, and the operation performed in the same room rather than in the operating-room. Afterwards the bacilli were repeatedly recovered from the room, five separated disinfections being required to remove them; removal of the floor was at one time seriously contemplated. This shows the great importance of investigating rooms where fluids have fallen during operation, as otherwise subsequent patients might very easily obtain anthrax infection. Dr. Keen has communicated with Dr. Abbott, of the Philadelphia Bureau of Health, who has taken steps to secure from Professor Sclavo, of Italy, some of the serum which has been used with such good results. It is hoped that the serum may be kept on hand to use in future cases.

Dr. De Forest Willard believed that even when serum treatment is employed, the original point of infection in anthrax should be excised in order to get rid of all the infection possible. He detailed a very severe case that occurred in a wool-sorter. There was a pustule with blebs and an ulcer of the cheek; anthrax bacilli were present in great numbers. Immediate diagnosis was followed by immediate removal of the pustule and by cauterization. Though there was great local œdema, speedy amelioration of the local symptoms followed. The patient, however, apparently infected his food, and in two or three days there was enormous distention of the abdomen with tormina and tenesmus, twenty or thirty stools occurring daily. Suppuration followed, and three quarts of pus were removed from the abdomen and several ounces from the scrotum. For weeks the patient was

almost at the point of death, but he finally recovered. Antistreptococcic serum was employed during a week or two, but incision appeared to do the most good. The patient was isolated and none of the attendants became infected. The room was thoroughly disinfected, and no other case developed.

Dr. John H. Jopson spoke of the frequency of anthrax in Philadelphia; he regards it as more common than most physicians suppose. He saw and reported a case some years ago from the Episcopal Hospital dispensary, it being the first of a small series of cases occurring among the morocco workers in that neighborhood. Mutchler, Miller, Willard, and Given have also reported cases, at least eight, occurring during the past ten years. Three were treated in their own homes by hypodermic injections of carbolic acid and recovered.

Dr. Royer, in closing, said the precautions taken with the patient at the Municipal Hospital consisted in keeping him in a tent and disinfecting the discharges with 3 per cent. solution of carbolic acid for one-half day. The nasal secretions and sputum were collected on gauze and immediately burned. The linen was soaked one-half day in 3 per cent. carbolic acid, then steam sterilized, boiled, and washed. The question of disinfecting the outfit when the patient left the hospital was solved by placing the tent, bedding, and other contents in the large steam sterilizing apparatus used in disinfecting clothing for the city and subjecting them to live steam, under five pounds pressure, for one hour on each of three days. Three test objects containing anthrax bacilli were also exposed, one being removed at the end of each sterilization; the bacteria were all destroyed. The bedding has since been used with no untoward result.

## FILLING DEFECTS IN THE SKULL BY BONE CHIPS FROM THE OUTER TABLE OF THE NEIGHBORING BONE.

Dr. W. W. Keen reported the case of a man, aged twenty-four years, first seen by him September 15, 1903.

Three years previously he had received a violent blow from a golf-stick on the forehead just below the border of the hair and about 1 centimetre to the right of the median line. The golf-stick was broken and a portion of it was left sticking in the wound. He was knocked down by the blow and stunned. With assistance, in a few minutes he got up and walked to the house.

He was never unconscious, was never sick enough to be in bed. A local doctor who was called seized the bit of golf-stick, pulled it out, and sewed up the wound. Healing took place by first intention, and the wound never gave him the slightest trouble in the way of headache, pain, or other disturbance until about a month ago, when a small abscess formed at the site of the accident and discharged a little pus. The day after the accident he went with a party of young people on a "hay ride." Neither he nor his doctor or friends had the least idea that his skull had been fractured.

Examination revealed, just below the border of the hair, a scar about 3 centimetres long and at its middle a sinus, the result of the old abscess. A probe discovered some bare bone.

An incision was made in the line of the old scar, which disclosed an unsuspected triangular bit of wood 1.5 centimetres long, 8 millimetres broad, and 4 millimetres in thickness. As soon as this was removed, it was apparent that it had filled up a depression which was 1 centimetre deep. At the time he received the blow, the skull had been fractured with depression of the fragment, and implantation of two pieces of the golf-stick in the wound. One piece had been removed, and this second piece of wood, together with the tissues about it, filled up the depression, so that no irregularity existed on the surface.

Inasmuch as Dr. Keen had seen two cases of fibroma and sarcoma result from such a depression of the skull, and epilepsy in many other instances, he deemed it essential that the depressed portion of bone should be removed. Accordingly, he carefully chiselled the depressed portion through until he reached the dura, and then by means of the rongeur forceps removed all of the depressed bone. The depressed portion exercised considerable pressure on the dura. In removing it he had to uncover the superior longitudinal sinus. The opening that he made was 3 by 2 centimetres.

The patient made a prompt recovery without any rise of temperature whatever.

A second operation to fill in the aperture in the skull was done February 23, 1904. He first made a flap, including the old scar and the scalp on each side of it, by a semicircular incision with its convexity posterior, the ends of which barely reached the border of the hair; the rest of it being therefore covered by the

hair. From this first incision he made a second directly backward. Dissecting these flaps away, he was able finally to lay bare the dura and the healed margins of the opening. By the rongeur forceps he made the margin raw all around the opening. He then chiselled a number of pieces from the outer table of the skull under the flap that he had turned back and filled in the opening in the skull entirely. The flaps were then replaced and sewed together, a small bit of folded rubber dam serving as a drain for twenty-four hours.

The man made a perfectly smooth recovery without any rise of temperature. On the ninth day he went home. The ugly depression on his forehead which had existed prior to this operation had entirely disappeared, and, with the exception of one point where there was a very slight prominence of one of the bone chips, his forehead was entirely normal.

In the autumn of 1904, six or seven months after the last operation, he was seen, and it was found that the inequality in the surface of the skull had entirely disappeared.

Dr. Keen remarked that this case was worth reporting on account of the entirely unsuspected nature of the injury, for no one examining his skull would have supposed that there was a depressed fracture. In addition to this, the mode of filling up the aperture is one which he first proposed probably eight or ten years ago. He had now practised it in fully a score of cases. This is the smallest opening he had filled by these bone chips chiselled from the neighboring outer table. In other cases he had filled in areas 6 to 7 centimetres by 3 to 5 centimetres, in other words, large openings. The skull becomes in time very solid and strong, reproducing practically a normal skull so far as both outline and protection are concerned. The margins of the opening, of course, should always be made raw by the rongeur forceps, and the pieces of bone which fill in the opening should not be too large. He had found the best instruments for procuring them are a gouge and mallet. Never in a single instance had he had any of the pieces of bone undergo necrosis, and so to require removal.

## EXCISION OF THE TIBIA.

Dr. Francis T. Stewart said that he was indebted to Dr. Le Conte for the privilege of operating upon and reporting the following case:

The patient is a Polish boy, aged ten years, from whom it was difficult to obtain any definite history. About seven months ago the right knee and leg suddenly swelled and became excessively painful. The patient was confined to bed for several weeks with marked constitutional symptoms, and has not been able to use the leg since. There is no history of injury. At the time of operation, the entire tibia and the lower end of the femur were markedly thickened, and the knee was ankylosed at an angle of about 40 degrees. Along the course of the tibia were numerous sinuses leading down to necrotic bone. Under ether a feeble attempt to straighten the knee resulted in a fracture of the femur just above the condyles, thus allowing the limb to be fully extended. An incision was made down to the tibia from the knee to the ankle and the entire diaphysis excised subperiosteally, leaving the lower epiphysis and a shell of the upper. In curetting the upper epiphysis the instrument at one point entered the knee-joint, which was found to be filled with hard, fibrous tissue. The entire wound was packed with sterile gauze and the limb placed in a fracture-box. Bacteriological examination of the specimen showed the infection to be that of the Staphylococcus pyogenes aureus.

Dr. Stewart said that he had had two other similar cases, one concerning the tibia and the other the fibula. The tibial case was a boy of twelve years who developed an acute osteomyelitis following a trivial injury. The limb was treated for four weeks with poultices, at the end of which time he saw him and excised the bone subperiosteally, saving the upper and lower epiphyses. At the end of six months the tibia had regenerated and was much thicker than normal. There was a little flexion of the knee and a slight varus of the leg, but withal a useful limb. In the fibular case, a boy of nineteen years, a contusion of the outer side of the leg was followed within a few days by marked constitutional disturbance, which was diagnosticated typhoid fever. Four months later he saw the patient, and removed the bone subperiosteally, excepting a small portion of the upper and lower ends. The infection in this case proved to be the Staphylococcus pyogenes aureus. The bone regenerated promptly, and the patient returned to his work as a laborer at the end of six months.

At the 1904 meeting of the American Surgical Association, Dr. Johnson read a paper on this subject, and among other points

emphasized the following: Regeneration in all his cases, six in number, was rapid and complete. Deformity never results where a disc of bone is left between the shaft and the epiphysis. The companion bone invariably takes on compensatory hypertrophy. During the operation the periosteum should be spared as much as possible, and the curette should be used very cautiously. The leg should be immobilized in a fracture-box and frequent and rough dressings avoided. The part should be moulded with bandages or adhesive strips as bone tissue develops, and the young bone should be protected by means of plaster of Paris.

Nichols (*Journal of American Medical Association*, February 13, 1904) states that the reason the regenerated bone is at first much larger than the original shaft is that the bone is not completely ossified. In time the size decreases almost to normal, and, judging from skiagrams, a new medullary canal develops. He thinks the best time for operation is about two months after complete drainage of the acute infection.

In regions, such as the thigh or the arm, where there is no companion bone to act as a splint and maintain the length of the part, one should wait until the periosteal shell of regenerating bone is sufficiently advanced to preserve the contour and bear the weight of the limb. Roughly, this stage is reached when the periosteal shell, as determined by the X-ray, is equal to one-fourth of the diameter of the original shaft.

Dr. Robert G. Le Conte said that he had operated upon six cases of osteomyelitis where the whole shaft of the tibia was involved in the disease. These cases varied from the very acute to the very chronic stages of necrosis, the duration of the disease being from five days to seven or eight months. He believes that the deposition of bone from the unremoved periosteum depends upon the length of time the disease has lasted. In the chronic cases, months after the onset of the acute symptoms, the regeneration of bone is reduced to a minimum, while in the acute stages, say two or three weeks after the onset of the disease, the periosteum is in an active state for bone regeneration. In the personal cases mentioned, more or less good bone was formed in four of the patients with useful limbs; partial deposit occurred in one, and in the other no bone whatever was formed.

Dr. De Forest Willard said his experience had not been so favorable, since regeneration of bone is slow and imperfect in old

cases. Osteomyelitis should be treated as is appendicitis, by early diagnosis and early operation within forty-eight hours if possible, not waiting until the case has been treated for months for other diseases, as rheumatism, typhoid fever, etc.

Dr. John H. Gibbon referred to the report of a case by Dr. Huntington, of San Francisco (Annals of Surgery, February, 1905), in which the entire shaft of the tibia had been removed and the shaft of the fibula substituted. After the removal of the tibia the result was not completely satisfactory, and the author divided the fibula near one of its extremities and attached it to the corresponding epiphysis of the tibia. A few months later the other end of the fibula was also divided and attached to the other epiphysis of the tibia. The result of this transference was most satisfactory.

Dr. Stewart, in closing, said that several cases of bone grafting had been reported. The bone is obtained from the same individual or from animals. Morton used in one case bone from a dog, and Senn has employed a similar expedient, using bone from the same individual.

# TRANSACTIONS

OF THE

# CHICAGO SURGICAL SOCIETY.

*Stated Meeting, March 6, 1905.*

The President, Dr. L. L. McArthur, in the Chair.

## DERMOID CYST OF LUNG.

Dr. Nicholas Senn presented a man, aged twenty-three years, American, unmarried, a railroad man by occupation, who entered the Outpatient Department of the Michigan University Hospital in July, 1904. The case was carefully studied there, and a history of it accurately reported by the attendants at the clinic, and particularly by Dr. Roger S. Morris, by whom a complete history of the case was published in the *Physician and Surgeon* of January, 1905. The history of the case as related by Dr. Morris is as follows:

"The patient was admitted to the medical ward of the University Hospital on July 27, 1904, and the following history was obtained:

"On admission the patient complained of cough, expectoration of large quantities of foul-smelling sputum, and hæmorrhages from the lungs.

"About nine years ago (eight years, according to out-patient history), that is, about the time of puberty, the patient had a severe attack of pneumonia on the left side, followed by a feeling of tightness across the chest and pain on breathing; the latter was localized to an area about the size of a hand in the precordial region. Prior to the attack of pneumonia the patient says he was struck over the heart by a drunken man, and ascribes

the pneumonia which soon followed to the blow which he received. Between the time when he was struck and the development of the pneumonia, he had severe neuralgic pains in the region of the heart and in the left shoulder. A year later the patient had another attack of pneumonia, which lasted about eight weeks. During a coughing fit a large quantity of 'pus' was coughed up at one time ('over one quart'). The 'abscess' or 'empyema' discharged three times in the next three or four days. The patient describes the so-called pus as a 'yellow, semi-fluid material.' After raising this material, the patient became much better, but has coughed and expectorated a good deal ever since. Four years ago the patient had a very severe hæmorrhage from the lungs, and since then he has had one about every six months. The last one occurred just before the patient returned to the hospital. At times the hæmorrhages amount to about one pint. During the last three years the patient has noticed a 'rotten' odor to the sputum. In March, 1904, he went to Colorado for his health. He was examined by a physician, and told that he had empyema; operation was advised. This the patient did not submit to. No tubercle bacilli were found in his sputum at this time. For some time the patient has coughed up hairs in his sputum; these are from one to six inches long. Since last March there has been some soreness over the right side of the chest. Expectoration is much more profuse when the patient is lying down. He has not lost weight.

"*Status Præsens.* July 29, 1904. Temperature has been normal since admission; respirations, 20; pulse, 72, regular, of fair size and tension.

"Thorax is well formed, rather large. The left side seems slightly fuller than the right. The epigastric angle is about a right angle. Expansion is rather small, slightly less on the left side, especially on deep breathing; the difference is more noticeable in the lower part of the thorax. The clavicles are equally prominent. On percussion the apices are of equal height, about one and one-eighth inch above the clavicles. Above the second rib the percussion note is the same on the two sides. Below this level the note is somewhat hyperresonant on the right, with relative dulness throughout the left front, the *upper border of the relatively dull area sloping downward and backward into the left axilla.* Traube's space is clear. There is no

absolute liver-dulness. The lung liver border is on the sixth rib in the right nipple line; it extends straight around. The lung descends to the seventh rib on deep inspiration. Auscultation above the right clavicle gives rather harsh vesicular breathing, with fairly high-pitched sibilant râles on inspiration; below the clavicle throughout the right side there is moderately strong vesicular with no adventitious sounds. Above the left clavicle the breath sounds are obscured by sonorous rhonchi, which are heard both on inspiration and on expiration. Below the left clavicle there is harsh vesicular accompanied by dry râles of medium pitch, the vibrations of which can be felt on palpation. Below a line drawn from the anterior axillary fold to the left nipple the vesicular is very weak, and towards the end of inspiration a few crepitant râles are heard. The auscultated spoken voice is slightly weakened between the second and fourth ribs on the left; vocal fremitus unaltered here.

"Posteriorly the apices are of equal height on percussion. Below the level of the spine of the eighth dorsal vertebra there is relative dulness on the left side; this is continuous with that previously described in the axilla. In other respects percussion of the back is negative. The upper border of relative dulness does not move with change in position of the patient. Auscultation reveals fair vesicular throughout the right back and on the left back down to the dull area, where the vesicular is weak and distant. Pectoral fremitus is slightly weaker on the left side over the same area. Auscultation of the spoken voice is negative behind.

"The apex of the heart is best felt in the fourth intercostal space in the nipple line. At the beginning of the examination a pulsation was seen in the second and third interspaces, which was forcible enough to be palpated. Absolute heart dulness begins on the fourth rib and extends outward to the apex; on the right it extends to the left sternal line. The relative heart dulness cannot be separated from that obtained over the left lung. The heart sounds are moderately strong and clear. The second pulmonic is reduplicated and accentuated.

"Abdomen is on a level with the ribs. It looks natural. The walls are quite resistant, making palpation difficult. Spleen and liver are not felt. Percussion is negative.

"Leucocyte count 9256 on July 27, 1904. Urine examination was negative.

"Sputum was examined July 31, 1904. The color was whitish-gray. Sputum had a foul odor, like that of 'bad' eggs. It separated into three layers. No tubercle bacilli were found; no elastic tissue. Later a hair was found in the sputum.

"Fluoroscopic examination shows a slight shadow throughout the left side above. Below the level of the eighth dorsal spine and extending to about the level of the eleventh dorsal there is a diffuse dark shadow, as dark as that from the liver. The entire right side is clear. A skiagraph was taken; unfortunately, the negative was poor."

Dr. Senn stated that this clinical history was very full and accurate and corresponded exactly with what he had found on careful examination of the patient repeatedly after his entrance to the Presbyterian Hospital. The patient coughed up, during his residence in the hospital for a number of weeks, six or eight hairs. These hairs were very thin, lighter in color than the hair of the scalp, and varied in length from one to six inches. Sometimes, when patient expectorated these hairs, he felt a certain sensation which he referred to the base of the heart. Expectoration at times had been very copious and fœtid. The patient's general condition was excellent. There was no wasting, no cachexia, hence any suspicion of tuberculosis could be abandoned without giving the chest a careful examination. He had made use of the X-ray in this case, and the skiagraph exhibited corresponded to what Dr. Morris had described in the clinical history. From the clinical history, the character of the sputum, the general condition of the patient, there was no difficulty in making an absolute diagnosis of dermoid cyst communicating with the lung.

He resorted to a surgical operation for the purpose of exposing, if possible, and removing the lining membrane of the dermoid cyst. Clinical records showed at the present time almost invariably that these cysts had their location in the anterior mediastinum at a point corresponding with the location of the thymus gland. This was their favorite primary location. He therefore aimed, in operating upon this patient, to expose that portion of the mediastinum which was most frequently the seat of dermoids of the lung. He made a T-shaped incision, which remained well defined by the scar which followed as soon as the wounds had healed, largely by primary intention. He made a transverse in-

cision directly over the manubrium, and a vertical incision over the centre of the sternum. As he wanted to trephine the manubrium at a point corresponding with the location of the thymus gland, he made another or second opening two inches lower down, after reflecting the cutaneous flap and periosteum, which were separated from the sternum, and united these trephine openings by the use of a chisel, thus making an opening more than two inches in length in its vertical diameter, exposing freely that part of the anterior mediastinum which was generally the seat of dermoid cysts. The moment he opened up the anterior mediastinum by cutting through the posterior layer of the periosteum, air entered forcibly. Hæmorrhage was quite profuse. He enlarged the opening to correspond to the size of the trephine openings, and this exposed freely the anterior mediastinum. Owing to profuse hæmorrhage, he packed the large wound with iodoform gauze, and allowed the gauze tampon to remain for five or six days, when it was removed, and when he anticipated, in all probability, he would find the remains of the dermoid cyst in the expected location. In this, however, he was disappointed. In removing the tampon he found that the entire part of the anterior mediastinum which was exposed lined fairly well with granulations. He proceeded to explore the floor of the wound with the probe, but no trace of the dermoid cyst could be found. The operation had not influenced the clinical course of the disease. Before resorting to operative measures, and knowing nothing about the previous history of the case, for the purpose of locating, if possible, the dermoid cyst accurately, he resorted to exploratory punctures. He found, as Dr. Morris did, an area of dulness corresponding with the upper segment of the sternum and at the base of the heart. He explored about an inch and a half from the left margin of the sternum and a little above the base of the heart to the depth of three or four inches, resorting to aspiration, gradually withdrawing the needle, but the result was negative. He found likewise a limited area of dulness which corresponded with the intrascapular region, that is, between the spinal margin of the scapula and the transverse process of the spine. In this locality he punctured, but with a similar negative result. The patient coughed now about the same as he did before the operation, so that the question arose as to what was to be done in the future. He exhibited the patient with a view of

asking the advice of the members of the Chicago Surgical Society as to the course to be pursued in the future. He could do nothing more with the anterior mediastinum. The patient had a slight area of dulness extending over the base of the heart, with a similar area of dulness on the posterior surface of the lung. He thought he had to deal here with an exceptional case. In nearly all, if not all, cases of dermoid cyst of the lung it was found to take its origin in a location corresponding with the thymus gland. That part of the mediastinum had been thoroughly explored. Nothing was to be gained by repeating the operation in that locality. He took particular care to use a probe in all directions in search for a possible sinus communicating with the supposed original seat of the disease.

The question arose now, should he resort to costal resection at a point to which the patient referred his difficulty, namely, above the base of the heart, or should he, in view of the fact that distinct physical evidence of pulmonary complications, or, at least, pleural thickening over the posterior aspect of the chest had been found, operate in that locality?

He had kept the wound open for a number of weeks with a view to studying repeatedly the condition of the anterior mediastinum, which was exposed by the operation. The arch of the aorta could be seen in the lower part of the wound. The operation wound had now completely healed, yet the patient was in the same condition as he was before operation.

## ECHINOCOCCUS CYST OF LUNG.

DR. SENN presented an adult man, a Greek, who came to the United States about five years ago. Six years ago he complained of acute, sharp pain, which he referred to the left side and to the upper segment of the lung. From that time on he had had occasionally some difficulty in breathing and attacks of coughing. The intrathoracic affection had evidently had but very little influence upon the general condition of the patient. He was sent to the Presbyterian Hospital by Dr. Volini, a very competent physician, who gave the case very careful investigation without coming to any positive diagnostic conclusion. When patient entered the hospital his general condition was fair. On physical examination of the chest a distinct, well-defined, rather diffuse area of dulness was found over the left side and the

upper part of the lung. This area of dulness was mapped out and extended from about the third rib across the upper section of the chest well beyond the left side of the nipple-line, this area of dulness being accompanied by physical signs pointing to pulmonary compression. Vesicular respiration on the right side was exaggerated; on the left side very feeble, and at a point corresponding to the area of dulness there was well-defined bronchial breathing, showing that pulmonary compression was limited. As this area extended well over the sternal region, a number of possibilities were taken into consideration. It was believed the case might be one of dermoid in the anterior mediastinum. With a view to making, perhaps, an absolute diagnosis with more direct methods of examination, he resorted to exploratory puncture a number of weeks ago. He punctured at about the centre of the dull space to the depth of three or four inches, aspirating repeatedly as the needle was withdrawn, but the result was negative. The same night the patient was seized with a violent attack of coughing, and coughed up about a pint and a half, if not a quart, of fluid, which represented the contents of the cyst. On microscopical examination, in the sputa were found echinococcus hooklets and scolices. After examining the contents of the cyst an absolute diagnosis was made of echinococcus of the lung. The rupture of the cyst was followed by a violent reaction. Some of the contents of the cyst escaped into the neighboring bronchial tubes, lighted up a rather severe inflammation, followed by a rapid rise in temperature, with corresponding constitutional disturbance. The inflammation remained limited to the bronchial tubes. There was a limited bronchitis incident to the irritation produced by the contents of the cyst. The patient gradually recovered, his expectoration becoming less and less, and instead of dulness resonance was elicited on percussion. A number of days after spontaneous rupture of the cyst, physical examination of that part of the lung showed distinct vesicular breathing, so that he was satisfied that, while the cyst had been punctured, he had failed to remove any of its contents, and he was strongly tempted after this, fearing that the contents of the cyst might produce fatal pulmonary or other complications, to resort at once to a radical procedure, open up and drain the echinococcus cyst. The patient was very ill, and this surgical undertaking would have been a risky one; hence Dr. Senn

put faith in nature's resources, waited a time, and was now fully rewarded by the conservative treatment pursued, as there was now every indication that the ruptured contents of the cyst had escaped into the bronchial tubes and would be gradually eliminated by expectoration, and that later the wound would undergo definitive healing by a gradual process of cicatrization. There was now good resonance over the entire space that was formerly absolutely dull.

Dr. Senn said that echinococcus cysts were extremely common in Australia, particularly in Adelaide; and while in that country last summer he did not visit a hospital of any size without seeing from three to six or more patients who had recently been subjected to operative treatment for echinococcus cyst. He was told in Australia that the surgeons had had an enormous experience with this affection, although echinococcus cyst of the lung is comparatively rare. It affected largely the liver, then the lungs, kidneys, brain, in fact, no part or organ supplied with blood-vessels was entirely exempt. There one would find echinococcus cysts in all possible locations of the body. In Adelaide there was a case in the hospital, while he was there, in which a recent operation was performed for supposed appendicitis. Imagine the astonishment of the surgeon when he cut down upon the appendix and unexpectedly found behind the cæcum a suppurating echinococcus cyst. The operation was so common in Australia that even country physicians were anxious to perform it. It is to the Australian surgeon what the appendix is to the American surgeon. Surgeons in Australia attacked cases of echinococcus cysts fearlessly. Marsupialization was resorted to in these cases. This was a term frequently employed by Australian surgeons to indicate radical operation for echinococcus cysts and the treatment of other cysts by incision and drainage. One surgeon in Sydney, Dr. Thomas Fiaschi, wishing to cut short the progress of repair in such cases, had recently closed the wound without making provision for drainage. He found that no trouble followed from pursuing this course in any of the cases, and the results were all that could be desired. When the cyst involved the upper surface of the liver, a resection of the eighth or ninth rib near the costal arch was made, and with one bold stroke of the knife a cut made through the diaphragm into the cyst, the

index-finger inserted, the cyst pulled out, a drain inserted, and the operation was finished in five or six minutes.

### DENTIGEROUS TUMOR OF SUPERIOR MAXILLA.

DR. SENN showed a boy, nine years of age, who was struck four years ago with a piece of ice directly over the right superior maxilla. No serious immediate symptoms followed the accident. A year later a swelling was discovered on the right side of the nose, involving the anterior wall of the antrum of Highmore. The swelling gradually increased in size, and interfered somewhat with the free passage of air through the nostril on the corresponding side. The patient entered St. Joseph's Hospital, and on examination Dr. Senn found a marked prominence on the right side of the nose involving the anterior antral wall. Dr. Senn exposed the bone by an incision along the lower border of the orbital margin and the entire length of the nose down to the end of the ala of the nose; when the bone was chiselled into, it was evident that he had to deal with an osteoma. He then resorted to resection of the upper part of the maxilla, including a part of the floor of the orbit. The tumor extended into and had largely obliterated the antrum of Highmore. As he carried his operative attack lower down in the direction of the alveolar process, he found the direct cause of the osteoplastic process in the shape of two imperfectly developed teeth. These misplaced teeth had acted as an irritant, producing a localized hyperplastic process which terminated in the formation of so-called osteoma. The wound healed by primary intention throughout.

### LIGATION OF INTERNAL AND EXCISION OF EXTERNAL CAROTIDS FOR MALIGNANT DISEASE.

DR. SENN presented a patient in whom he had performed the so-called Dawbarn operation, which means the excision of the external carotid, with all its branches, in dealing with malignant disease about the pharynx or the submaxillary region. The patient was advanced in years, and was operated on two years ago for a well-defined, but limited, epithelioma of the lip. Within a year submaxillary lymphatic infection was discovered, for which a second operation was performed. A few months after the second operation there were indications of very extensive lym-

phatic infection involving the floor of the mouth and the entire submaxillary space. Through the intact skin he could discover enlarged glands along the anterior border of the sternocleidomastoid. The case was an unpromising one for further operative procedure. Through an incision which extended from the external ear forward to the symphysis of the lower jaw, and through an incision along the anterior border of the sternocleidomastoid downward to near the sternal notch, he exposed the entire field of infection. He isolated the common carotid, and followed it up to its bifurcation; he then ligated the internal carotid about half an inch above the point of bifurcation, and followed this by an excision of the external carotid with all of its branches, including in the excision all the infected submaxillary lymphatic glands, the salivary gland, the floor of the mouth on the corresponding side, and all the glands along the sheath of deep vessels of the neck. Owing to the age of the patient, he was very apprehensive at the cutting off of so much blood supply to the brain, thinking it might result in what he had observed before in some, paresis, if not paralysis, of the opposite side of the body. Nothing of that kind followed. This enormous wound healed satisfactorily, with the exception of a point at the posterior angle, where there was direct communication with the cavity of the mouth. The wound is now healed and the patient had fully recovered from the effects of the operation, and so far there were no indications of recurrence. He had performed this operation three times, and one of his patients died promptly within the first twenty-four hours thereafter. It was therefore an operative procedure, the propriety and application of which must be carefully weighed. However, in a case like the one under discussion it was an operation that was justifiable. It gave him an opportunity to remove the disease with the requisite degree of thoroughness, and he cut off so much of the blood supply in the region operated on that it weighed heavily in the balance of at least temporary success.

## DISARTICULATION AT THE HIP-JOINT FOR SARCOMA OF FEMUR AND TUBERCULAR TENDOVAGINITIS.

DR. SENN exhibited pathological specimens obtained from a complicated case. Three years ago, a young man, in fair health, presented himself at his clinic at Rush Medical College, being the

subject of a large, painless swelling which involved the centre of the thigh. The swelling was spindle-shaped, and involved largely the anterior and lateral aspects of the thigh. There were no general indications of malignancy; no suspicions of an acute inflammatory process, but of a chronic affection that came on gradually and painlessly. He cut down upon this swelling and opened up a large cavity, from which he removed 262 rice bodies. These rice bodies varied in size from a pinhead to a small chestnut in the fresh state. They were structureless bodies. They were bodies which one would recognize wherever found as the typical products of tubercular inflammation. He removed all of these bodies, but this did not remove the entire swelling. There was not only this large and irregular cavity, but the femur itself was enlarged. He cut down upon it, chiselled into it, and found firm bone. This large wound healed satisfactorily, and the patient returned home satisfied with the result of the operation. About a year and a half later he returned. The swelling then had changed in its character. There was no fluctuation. This time there was a solid, firm, cylindrical swelling involving distinctly the shaft of the femur and encroaching well up towards the hip-joint. The clinical evidence pointed clearly to malignancy. He accordingly resorted to disarticulation at the hip-joint. The wound healed by primary intention. A year later he again returned, and Dr. Senn was puzzled with the appearance at the site of the former operation. He found a typical stump, such as one would expect after a subtrochanteric amputation of the thigh, but the hospital records said "amputation through the hip-joint." He then removed by a very difficult operation this stump, which proved to be a bony mass which had formed immediately below the acetabulum since the disarticulation of the thigh. The stump was immovable, due to the fact that this large mass of bone had formed extensive connections with the ischium, which had to be severed with a chisel. The site of the former acetabulum was very shallow; the tumor was connected with the ascending and descending ramus of the ischium, and there was a reformation of the periosteal sarcoma in the soft tissues after disarticulation of the thigh. The patient again recovered promptly.

A section under the microscope gave the histologic features of a spindle-celled periosteal sarcoma.

## EXTENSIVE PLASTIC OF FACE AFTER OPERATION FOR CARCINOMA OF ORBIT, NOSE, AND FACE.

DR. SENN exhibited some illustrations showing an extensive plastic operation after a radical operation for malignant disease of the orbit, where the eye had yet remained intact, but the disease extensively involving the orbit had destroyed a part of the nose and a considerable portion of the face. A very extensive operation had to be made. He took a flap, the size of a hand or larger, from the parietal region, with which to cover the enormous defect. These cases were usually very fatal, but this particular case demonstrated that sometimes in apparently hopeless cases in performing a radical operation one is rewarded with unexpected results. The patient returned three years later with a recurrence which involved a small part of the left ala of the nose which was left after the operation, and this small carcinoma was excised.

## RECTOPLASTY FOR EXTENSIVE TRAUMATIC DEFECT.

DR. SENN described a case in which by the accidental discharge of a shot-gun the patient lost about one-third of the anus, the whole posterior wall of the rectum, and the entire coccyx. Two operations were performed for the purpose of correcting the enormous prolapse of what remained of the rectum, but with negative results. Dr. Senn exhibited a photograph which showed the appearance of what remained of the rectum before operation. It showed well the enormous rectal prolapse. In this case he separated the margins of what remained of the rectum on both sides from the cicatricial connections sufficiently free, so that the vivified margins could be readily brought together; sewed, first, the entire thickness of the bowel wall with bronze aluminum wire, buried this row of sutures with two rows of catgut, leaving about two inches of the bowel and anus to be restored by a second operation. There was primary union of the first wound, and the wound at the second operation healed throughout, with perfect restoration of the sphincter muscle, and complete correction of the prolapse.

## SCAR CARCINOMA IN REGION OF GREAT TROCHANTER.

DR. SENN detailed the history of a patient, sixty-seven years of age, who had an abscess in the subtrochanteric region some

thirty-two years ago. Two years ago there was a beginning carcinomatous process in the scar, with rapid extension of the disease and extensive undermining of tissues, so that he had to remove a very large part of the soft tissues, including the carcinomatous undermined ulcer, which gave rise to an enormous defect which he had to cover. He then made a transverse incision down to the deep fascia, extending from the sacro-iliac joint to the large vessels, dissected up the two large triangular flaps, and brought them together with sutures without harmful tension. Healing of the enormous wound retarded by a superficial infection, sections under the microscope showed the typical structure of scar carcinoma.

## FRACTURE OF HUMERUS, WITH POSTERIOR DISLOCATION OF UPPER FRAGMENT.

DR. SENN exhibited a Röntgen illustration of a fracture of the humerus in the middle of the shaft, and asked particular attention to the condition of the shoulder-joint. The patient suffered from a severe accident, one in which a revolving shaft had twisted the arm and brought about the fracture, with injury of the shoulder-joint. Judging from the skiagraph, there was no dislocation of the humerus, the skiagraph being taken anteroposteriorly. The head of the humerus was shown at its proper level apparently in the glenoid cavity. An enormous swelling followed the accident, so that, when the patient was brought to the hospital, it was feared he was at the same time the subject of laceration of some large blood-vessel. By resorting to extension by weight and pulley and immobilization, in the course of two weeks the enormous swelling disappeared, and then it became evident there was something wrong with the shoulder-joint. He then found, without the use of the Röntgen ray, a dislocation of the head of the humerus backward. A skiagraph was taken from the side, which showed distinctly the existence and character of the dislocation. He then resorted to reposition, elevating under an anæsthetic the arm, and making on the upper fragment extension in an upward and forward direction, so as to relax the untorn portion of the capsular ligament. The first attempt failed, but the second succeeded in effecting reduction. This case showed that one could not always rely upon the Röntgen ray if the skia-

graph was taken from one direction in demonstrating the existence or absence of a dislocation of the shoulder-joint.

## SECONDARY SUTURE OF ULNAR NERVE AFTER GUNSHOT INJURY.

DR. SENN presented a man who had received a charge of bird-shot at close range, the shot penetrating the soft tissues at the inner aspect of the forearm below the elbow-joint, tearing away the ulnar nerve and artery with the muscles surrounding them. Suppuration set in, and there was a long tedious process of healing. When Dr. Senn saw the patient, eight months after the injury, there was complete paralysis of the territory supplied by the ulnar nerve, that is, the little finger and the ulnar side of the ring-finger, with characteristic contracture of the fingers. He excised the entire skin scar, exposed the ulnar nerve in the groove behind the internal condyle, followed it down to the massive deep scar tissue, expecting every moment to lose the track of the nerve, but was fortunate enough to dissect in the proper direction until he found the intact part of the ulnar nerve on the distal side some distance from the scar. He had then two inches of doubtful tissue. Was it all scar tissue, or was a part of the nerve incorporated in scar tissue? He relied upon a small neuroma which pointed out the termination of the proximal end, and following the cord downward excised the scar tissue, and resorted to secondary nerve suture with catgut, stretched both ends of the nerves, brought them together without tension, and dressed the arm in a flexed position. The wound healed by primary intention, and four days after the operation there was a return of sensation in that branch of the ulnar nerve which supplies the ulnar side of the ring-finger. When he examined the patient two days ago he found returning sensation extending down to the distal end of the first phalanx, showing rapid regeneration of nerve tissue, and probably perfect reunion, with restoration of function eight months after the original accident.

## THE SURGICAL TREATMENT OF MUCOMEMBRANOUS AND ULCERATIVE COLITIS, WITH SPECIAL REFERENCE TO TECHNIQUE.

DR. J. E. SUMMERS,, JR., of Omaha, Neb., read a paper with the above title, for which see page 97.

## DRAINAGE IN ACUTE SPREADING PERITONITIS.

Dr. Van Buren Knott, of Sioux City, Iowa, read a paper with the above title, for which see page 75.

Dr. M. L. Harris stated that his experience in reference to exclusion of portions of the intestine had always been limited to exclusion with drainage into the intestine. He had resorted to this method in several cases in which the cæcum and ascending colon were involved, and always with success. He had always made use of the method of dividing the ileum and transplanting it into some portion of the colon distal to the trouble which he sought to relieve. The colon was always left free, so that it could drain. He believed this was an essential feature, and thought that complete exclusion of any portion of the intestinal tract should never be undertaken.

Concerning the Fowler position, he thought it had been thoroughly demonstrated that it had distinct advantages and was quite commonly used by surgeons in cases of general peritonitis. The drains which he had used had been the soft rubber ones made with the rubber dam which corresponded practically to the large tube mentioned and exhibited by Dr. Knott.

Dr. Jacob Frank called attention to the fact that the first colostomy done for this disease was performed in 1885, by Folet, of Lille, France. The patient lived five days, and then died. In 1887, Drs. Durante and Novara did the same operation, with recovery of the patient.

As to antiperistalsis, previous to 1882, there was considerable debate among physicians and surgeons as to whether or not such a thing could occur. In 1882 he published the report of a case in the *Medical Record*. In this case he fed the patient beef-tea and milk by the rectum, and patient vomited these. When his attention was directed to this, he made observations, and found that this was the case. Dr. Albert Bernheim, of Philadelphia (*Journal of the American Medical Association*, February 16, 1901), in an article on "Movements of Intestines," records his observations on dogs into whose rectum he injected undigestive material. In the great majority of cases the dogs vomited the material injected. He stated this before the Section on Surgery of the American Medical Association at the Saratoga meeting, when Dr. Ochsner claimed that, by giving enemas or feeding per rec-

tum, there would be no peristalsis, and the speaker at that time claimed that there was such a thing as retroperistalsis by injecting foods or liquids into the rectum. He was glad that Dr. Summers brought this point out. If he was not mistaken, it went so far as the small intestine, but he thought by further investigation there would be found cases where it comes out by the stomach.

With reference to exclusion of the bowel, in some of the cases reported before the Chicago Surgical Society, it was demonstrated that in that part of the bowel which was excluded there were masses formed from the secretions or excretions from the mucous membrane. These masses consisted of small balls of cheesy substance filling up the excluded bowel. He did not think it was safe to close up both ends, as he had demonstrated this in dogs.

In regard to Dr. Knott's paper, he had tried the methods mentioned by him, and in two cases of diffuse septic peritonitis he filled the abdomen with salt solution, put the patients in the Fowler position, and used glass drainage-tubes, sitting them up in bed with a back-rest, and both recovered. These were the only two cases of diffuse septic peritonitis that he had ever had recover in his surgical practice of twenty years.

Dr. Daniel N. Eisendrath showed the photograph of an apparatus which had been in use in the Michael Reese Hospital for the past two or three years for the treatment of cases of diffuse septic peritonitis. The apparatus was designed by one of the head nurses. It consisted of a U-shaped arrangement upon a little pedestal, and by means of adjustable screws it can be raised to any height. The photograph showed a patient in the Fowler position. He thought this apparatus had advantages over using tables, chairs, or anything of the kind at random, as one could more accurately get the Fowler position, knowing how high this was. It was an advantage over the propping up of a patient in bed, for those who had had experience with such patients knew that in their weakened condition they would slip down.

Prior to the time of the use of the Fowler position the mortality from cases of diffuse septic peritonitis was practically 100 per cent. About a year ago, when he began to use the Fowler position systematically, and to flush cases of diffuse septic peritonitis thoroughly with hot salt solution, using three to four

gallons in each case, he changed his mortality from 100 per cent. practically to a large per cent. of recoveries. This, he agreed fully with Dr. Knott, was due in a great measure to adopting the Fowler position. He mentioned three cases in which he obtained successful results by this treatment. In one case he used a Mikulicz drain, which was perhaps the most satisfactory drain. In one of them the use of the Mikulicz drain was supplemented by a glass drain.

There had been some discussion as to whether these cases should be flushed or not, and whether one ought to use large quantities of salt solution or to eviscerate. He did not believe these cases should be eviscerated. He believed that flushing with salt solution accomplished the best results.

To illustrate the diversity of opinion, some would recall a discussion on appendicitis which took place last June at the meeting of the American Medical Association, held at Atlantic City. At this time Dr. Murphy stated that his mortality in sixteen cases by means of non-irrigation of diffuse septic peritonitis was one in sixteen. In other words, there were fifteen recoveries out of sixteen cases by opening them up, putting them in the Fowler position, and flushing. In the same discussion Dr. Mordecai Price stated that he was using nothing but his famous dipper and Schuylkill River water, and of seventeen cases of diffuse septic peritonitis treated by flushing, he saved all, so that one method, the speaker thought, seemed to be as successful as the other.

Dr. Alexander Hugh Ferguson said, with regard to the enlargement of the ileocæcal valve in chronic constipation, and the ill results of chronic constipation, as suggested by Dr. Summers, he had looked over this subject very thoroughly at one time, and thought he was the first to attempt to enlarge the ileocæcal valve for chronic constipation, but found that several others were ahead of him.

In a spreading inflammation of the peritoneum, one should not forget where the focus of the inflammation was when he began to drain. The Fowler position, which had been so much lauded and recommended, and properly so, should not supplant every means of drainage of the abdominal cavity. There were three positions from which pus emanated that should not be drained by the Fowler position. Take, for instance, the gall-

bladder region, Morrison's pouch. This pouch could not be drained with the patient in the upright position; and if it did drain pus by the upright position, with a phlegmonous and perforative inflammation of the gall-bladder, it would be a deleterious, if not fatal, thing for the patient, by carrying that material down into the peritoneal cavity. The patient should, therefore, be in the horizontal position and drainage established anteriorly or laterally at the tip of the twelfth rib, so that one could lay the patient on the side, and this pouch, which would hold about a pint of fluid normally, would be emptied, and there would be no chance for the fluid to trickle down among the small intestines over the transverse bowel. An abscess of the liver may burst into the same region, and then the Fowler position is contraindicated. Perforation of the duodenum not infrequently took place in this same region, which needed to be drained laterally and not downward.

Dr. Summers remarked, as to the first colotomy for colitis, referred to by Dr. Frank, the best article ever written on mucomembranous colitis, was by W. Hale White, of Guy's Hospital. This article is in Allbutt's "System," and the date of the first operation was given therein. He was told by a surgeon, who had visited India, that English surgeons there had been operating for years on cases of mucomembranous disease of the large intestine, and this disease was supposed to be due to the climate. In "Hill Diarrhœa," when the sufferer got out of the hills, the disease disappeared. On the other hand, if he remained there long enough, mucomembranous colitis sometimes developed, and it was similar to that which is met with after dysentery.

With reference to retroperistalsis, as mentioned by Dr. Frank, he thought it did not occur in the small intestine; that the preponderance of evidence was against it.

Three or four years ago he read a paper on the Gibson fistula, as he had done a lot of work along that line, and had then referred to the Weir method. When one wanted to flush, a large opening was needed. If one could make a large valvular fistula which would be competent he could flush freely through it. He had always succeeded in doing that, and had removed the appendix because it was a good thing to do under the circumstances.

As to operating on the ileocæcal valve for constipation, to

gallons in each case, he changed his mortality from 100 per cent. practically to a large per cent. of recoveries. This, he agreed fully with Dr. Knott, was due in a great measure to adopting the Fowler position. He mentioned three cases in which he obtained successful results by this treatment. In one case he used a Mikulicz drain, which was perhaps the most satisfactory drain. In one of them the use of the Mikulicz drain was supplemented by a glass drain.

There had been some discussion as to whether these cases should be flushed or not, and whether one ought to use large quantities of salt solution or to eviscerate. He did not believe these cases should be eviscerated. He believed that flushing with salt solution accomplished the best results.

To illustrate the diversity of opinion, some would recall a discussion on appendicitis which took place last June at the meeting of the American Medical Association, held at Atlantic City. At this time Dr. Murphy stated that his mortality in sixteen cases by means of non-irrigation of diffuse septic peritonitis was one in sixteen. In other words, there were fifteen recoveries out of sixteen cases by opening them up, putting them in the Fowler position, and flushing. In the same discussion Dr. Mordecai Price stated that he was using nothing but his famous dipper and Schuylkill River water, and of seventeen cases of diffuse septic peritonitis treated by flushing, he saved all, so that one method, the speaker thought, seemed to be as successful as the other.

Dr. Alexander Hugh Ferguson said, with regard to the enlargement of the ileocæcal valve in chronic constipation, and the ill results of chronic constipation, as suggested by Dr. Summers, he had looked over this subject very thoroughly at one time, and thought he was the first to attempt to enlarge the ileocæcal valve for chronic constipation, but found that several others were ahead of him.

In a spreading inflammation of the peritoneum, one should not forget where the focus of the inflammation was when he began to drain. The Fowler position, which had been so much lauded and recommended, and properly so, should not supplant every means of drainage of the abdominal cavity. There were three positions from which pus emanated that should not be drained by the Fowler position. Take, for instance, the gall-

bladder region, Morrison's pouch. This pouch could not be drained with the patient in the upright position; and if it did drain pus by the upright position, with a phlegmonous and perforative inflammation of the gall-bladder, it would be a deleterious, if not fatal, thing for the patient, by carrying that material down into the peritoneal cavity. The patient should, therefore, be in the horizontal position and drainage established anteriorly or laterally at the tip of the twelfth rib, so that one could lay the patient on the side, and this pouch, which would hold about a pint of fluid normally, would be emptied, and there would be no chance for the fluid to trickle down among the small intestines over the transverse bowel. An abscess of the liver may burst into the same region, and then the Fowler position is contraindicated. Perforation of the duodenum not infrequently took place in this same region, which needed to be drained laterally and not downward.

Dr. Summers remarked, as to the first colotomy for colitis, referred to by Dr. Frank, the best article ever written on mucomembranous colitis, was by W. Hale White, of Guy's Hospital. This article is in Allbutt's "System," and the date of the first operation was given therein. He was told by a surgeon, who had visited India, that English surgeons there had been operating for years on cases of mucomembranous disease of the large intestine, and this disease was supposed to be due to the climate. In "Hill Diarrhœa," when the sufferer got out of the hills, the disease disappeared. On the other hand, if he remained there long enough, mucomembranous colitis sometimes developed, and it was similar to that which is met with after dysentery.

With reference to retroperistalsis, as mentioned by Dr. Frank, he thought it did not occur in the small intestine; that the preponderance of evidence was against it.

Three or four years ago he read a paper on the Gibson fistula, as he had done a lot of work along that line, and had then referred to the Weir method. When one wanted to flush, a large opening was needed. If one could make a large valvular fistula which would be competent he could flush freely through it. He had always succeeded in doing that, and had removed the appendix because it was a good thing to do under the circumstances.

As to operating on the ileocæcal valve for constipation, to

which reference was made by Dr. Ferguson, he referred to Mr. Lane's article on angulations, which might occur on both the right and the left sides, and form obstructions which could not be overcome except by switching the small intestine over into the large one. In some cases he thought this might advantageously be done. Some years ago Dr. Wm. J. Mayo operated on the ileocæcal valve for the relief of constipation, but these operations were failures. Operating on the ileocæcal valve or changing its form to stop constipation was puerile from the point of view of the author's paper, particularly with reference to its effect on digestion.

As to perforation of the duodenum, referred to by Dr. Ferguson, the speaker had two such patients at present convalescing in the hospital, and said that if the surgeon did not get the patient into the right position, and forgot about Morrison's pouch, he was apt to lose the case. In one of these, large quantities of fluid were found in Morrison's pouch. The patient had not only been given morphine hypodermically, but had had several drinks of whiskey, which had leaked, together with the other stomach contents, into the abdomen, and could easily be recognized even in the fluid from the pelvis. If, after opening the abdomen in these cases, the drainage in Morrison's pouch had not been established, together with pelvic drainage, he thought he might have lost the patients.

With reference to Dr. Knott's paper, he would say that Dr. Knott was so thoroughly convinced of the utility of the plan advocated in treating cases of diffuse peritonitis, that he operated upon his own son eighteen hours after an operation for perforative appendicitis by another surgeon. Dr. Knott had himself operated in the absence of a colleague, an acute peritonitis having developed. The extra median incision, toilet, and drainage established saved the boy's life.